RAILROAD GAZETTE

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Contributions

The Turning Moments of Four-Cylinder Balanced Compound Locomotives.

Lafayette, Ind., Feb. 2, 1904.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Having read with interest the contributions of Mr. Coster and of "Q. E. D.," concerning the uniformity of turning moments in the De Glehn four-cylinder balanced compound locomotive, that have recently appeared in your columns, and having received from each of the disputants a personal note urging me to take part in the discussion, I venture to submit the following:

The progress of the discussion has, I think, given ample proof of the fact that in so far as the turning moment is dependent upon the arrangement of cranks, that of the de Glehn compound is not more uniform than that of the two-cylinder simple engine. It must be admitted, also, that crank arrangement is the principal factor controlling the character of the turning moments, but it is not the only one. Another factor is to be found in the changing value of the forces acting upon the pistons. Thus, in a compound engine, the range of pressure to which each cylinder is subject is less, and the number of expansions in each cylinder are fewer than in a simple engine. As a consequence, the pressures acting upon the piston of a compound engine are much more nearly constant than those of a simple engine. A comparison of the indicator cards from engines of the two types will show that the changes in pressure as the piston advances on its stroke are generally not more than half as great in a compound as in a simple engine. This statement remains true whether the high-pressure cylinder or the low-pressure cylinder of the compound is made the basis of the comparison. With such a difference in the range of pressures acting upon the piston, it is evident that the turning moments of the two engines cannot be identical. The extent of the differences in turning moment can best be determined by choosing typical indicator cards representing both types of engines, and by deriving from these, curves representing the tangential force. Such an analysis will probably show that differences in the turning moments of the two types of engines are not great, but that they are nevertheless of sufficient consequence to receive attention in any precise discussion of the subject.

W. F. M. GOSS.

Centenary of the Locomotive Engine.

BY W. B. PALEY.

Seventy years ago Richard Trevithick died, penniless and alone. Many, more successful in doing well for themselves, reaped the benefit of his life work, for the steam engine could never have been developed upon the original lines of low-pressure and condensation. Even Watt himself never to the end of his long life could get beyond the beam engine, with its single cylinder working by vacuum rather than by pressure. Trevithick was undoubtedly the first who saw the limitations this placed upon the usefulness of the steam engine.

He was born on April 13, 1771, in a district of Cornwall where Watt's pumping engines were largely employed in the mines, and was familiar with both their strong and their weak points from his earliest years. At 18 he assisted his father in charge of a mine and soon after was able to improve an old engine so much as to be able to claim payment for the saving of fuel it effected. In conjunction with Edward Bull, Trevithick worked for years at the difficult task of improving the steam engine without infringing the numerous patents of Boulton and Watt. By the simple expedient of turning the cylinder upside down over the pit shaft and attaching the pump rods to the piston rod, they dispensed with the whole clumsy system of beams, flywheel, parallel motion, etc. The rods were helped up again by a balance weight working on a pivot, though this, to a certain extent, represented the beam.

About 1798 Trevithick began to consider whether a steam-pressure engine might not be superior to the steam-vacuum system. His first efforts were called "whimseys" or "whim engines," for winding rather than pumping. So portable were they that on several occasions they were moved from place to place in a cart. They were also known as "puffers," from discharging the exhaust steam straight into the air. It seems probable that the first commercial application of high-pressure steam was in these portable steam whims. To making them move themselves about was not a long step from this, at any rate to a man of Trevithick's genius. After making several models, one of which is now at South Kensington, to prove the practicability of the idea, he set about making a "portable puffer," and started with it on a trial trip on Christmas Eve, 1801. The story is well known; how it went successfully up a steep hill with seven or eight persons, but a few days later the shock of crossing a gully in the road upset it. It was dragged, however, to a little shed and left while Trevithick and his cousin and partner, Andrew Vivian, dined at an inn near by. They had forgotten to draw the fire and on returning found the boiler red hot and nothing combustible remaining, either of the engine or the shed. Steps, however, were immediately taken to patent the invention. The patent is dated March 24, 1802, No. 2,599, and is in favor of Richard Thevithick and Andrew Vivian, of Camborne, Engineers and Miners. It shows a three-wheeled engine, the front wheel being used for steering, the carrying wheels, of large size, fitted with a small ring of cogs, driven by another cogwheel, on the axle of which was a crank turned by a connecting rod working backwards from near the end of a disproportionately long piston rod. The single horizontal cylinder was sunk in the upper part of the boiler, a favorite idea of Trevithick. There was a coach body mounted high above the machinery, capable of holding about four persons, but accessible, apparently, only by means of a ladder. It is supposed, from the recollections of a relative of Vivian's who made a trip on it, that a road locomotive the partners tried in London in 1803 was similar to this. The engine was built in Cornwall and taken to pieces for transit, but was re-erected and a coach body made and fitted to it by one Felton, a coach builder in Leather Lane, Holborn. It had a new cylinder and boiler, made in Cornwall, the former 5½ in. x 30 in., the latter of wrought iron. Hitherto Trevithick had used cast-iron boilers, but the weight in this case would have been prohibitory. There was a return-flue, the funnel coming out at one side of the fire-hole; the cylinder exhausted into the funnel and plenty of steam was made. Several trips were run and the machine was undoubtedly a mechanical success. London streets, however, were then poorly paved and the violent bumping frequently dislodged the fire-bars and let the fire fall through. No money came in to pay for the machine, the cost of the trips was heavy and at last the affair had to be sold for what it would bring. It is said the boiler and engine were used afterwards to drive a mill for rolling hoop iron.

Trevithick had seen plainly enough that with a smooth surface to run on, the engine would do very well, and within a few weeks he was constructing at Penydaran, near Merthyr Tydfil, the first locomotive which ever ran upon rails. The "rails," to be sure, were only tram plates of cast-iron, about 3 ft. long, with an inner flange to keep the wheels in their proper course. The tram road was a private one running from Merthyr down to the Glamorgan canal at Navigation House. Its course was nearly that of the present Taff Vale Railroad, between Quaker's Yard and Merthyr, and can still be traced in places. On it are said to have been gradients as steep as 1 in 18. According to Trevithick's own account his engine weighed, in working order, about five tons. It had a single cylinder fixed horizontally in the upper part of the boiler, 8¼ in. in diameter, with the ridiculous stroke of 54 in. It worked backwards by long connecting rods, formed of wood strengthened with iron, to cranks on the flywheel shaft which went across the other end of the boiler. A spur wheel on this shaft engaged with a larger one pivoted on the boiler side and worked in cogs on the carrying wheels of the engine, the cogs being fixed upon rims attached to the wheels at about half diameter. There was a pair of round slide bars carried upon two long curved stays which projected from the boiler end. One of the wooden connecting rods worked on to a pin fixed in a large flywheel on the driving axle and equalized the motion. It was about 8 ft. in diameter and of light make, with only four spokes. If the engine stuck on the center doubtless this large wheel was pulled round by the enginemen in the same way that single-cylinder road rollers and traction engines are now handled. As the crosshead carrying the connecting-rods was, of course, as long as the distance the crank-pins of the small pair of gear wheels were apart, and the fire-door of the return-flue boiler was at the same end as the cylinder, it must have been necessary to stop the machine whenever firing was required, owing to the long stroke made by the crosshead just above the furnace. In fact, it must have been rather an awkward job to fire her even when standing still. The funnel, of course, was at the same end as the fire-hole, on the left, or flywheel side of the engine. A distance of only 49 in. separated the centers of the axles; the wheels, therefore, being 45 in. in diameter, were very close together. Apparently these wheels were very narrow on the tread, a mischievous system common on all the horse tram-roads of the time, whereby a deep groove was soon worn in the tread of the plates. The funnel seems to have been a plain straight pipe of equal and very moderate diameter throughout, and rose to about 10 ft. above the rail level. In using this small diameter Trevithick showed himself a better mechanic than George Stephenson, who not only ignored the return-tube, but used a huge funnel with a single straight flue years after Trevithick had showed the way.

It is, perhaps, a little doubtful whether the boiler shell was of cast or wrought-iron. It was 51 in. in diameter by 72 in. long, and intended for at least 40 lbs. steam. Trevithick rather favored cast-iron for boilers, but there were many accidents with them and their dangerous nature probably led to much prejudice against the use of high pressure steam. George Stephenson, on the other hand, never would look at them. The return-tube was certainly of wrought-iron, as well as the boiler front plate. Steam was admitted to the cylinder of this curious-looking engine by means of a four-way cock, turned by a rod, with tappets upon it, carried on the upper side of the crosshead. There was another cock or regulator worked by hand, by which steam could be shut off from the casing which contained them both. Some drawings seem to show a small weighted safety-valve on or near this casing, but the exact details of this and of the pump and various other small matters are more or less conjectural.

In 1893 a full-sized model of Trevithick's engine of 1804 was built at Crewe by Mr. F. W. Webb, the well-known Chief Mechanical Engineer of the London & North Western Railway, after careful study of all the plans and documents available. Whilst there is every probability that the engine was as nearly as possible as represented, there is a certain element of doubtfulness about it. The drawings extant are at least as likely to show only what was intended to be made, and by no means preclude the possibility of the actually constructed machine having differed from them in several respects. The evidence of certain aged men taken about half a century after the trial trips of February, 1804, presents discrepancies in various points. The engine was in use such a very short time that no one could really have got sufficiently familiar with it to remember all its details after a long life spent in working a totally different class of machinery.

The plain and simple terms in which Trevithick announces the most momentous event of the nineteenth century are as follows:

Penydaran, Feb. 15, 1804.

Mr. Giddy.

Sir: Last Saturday we lighted the fire in the tram-wagon, and worked it without the wheels to try the engine. On Monday we put it on the tram-road. It worked very well, and ran up hill and down with great ease, and was very manageable. We had plenty of steam and power. I expect to work it again to-morrow. Mr. Homfray and the gentleman I mentioned in my last will be home to-morrow. The bet will not be determined until the middle of next week, at which time I shall be very happy to see you.

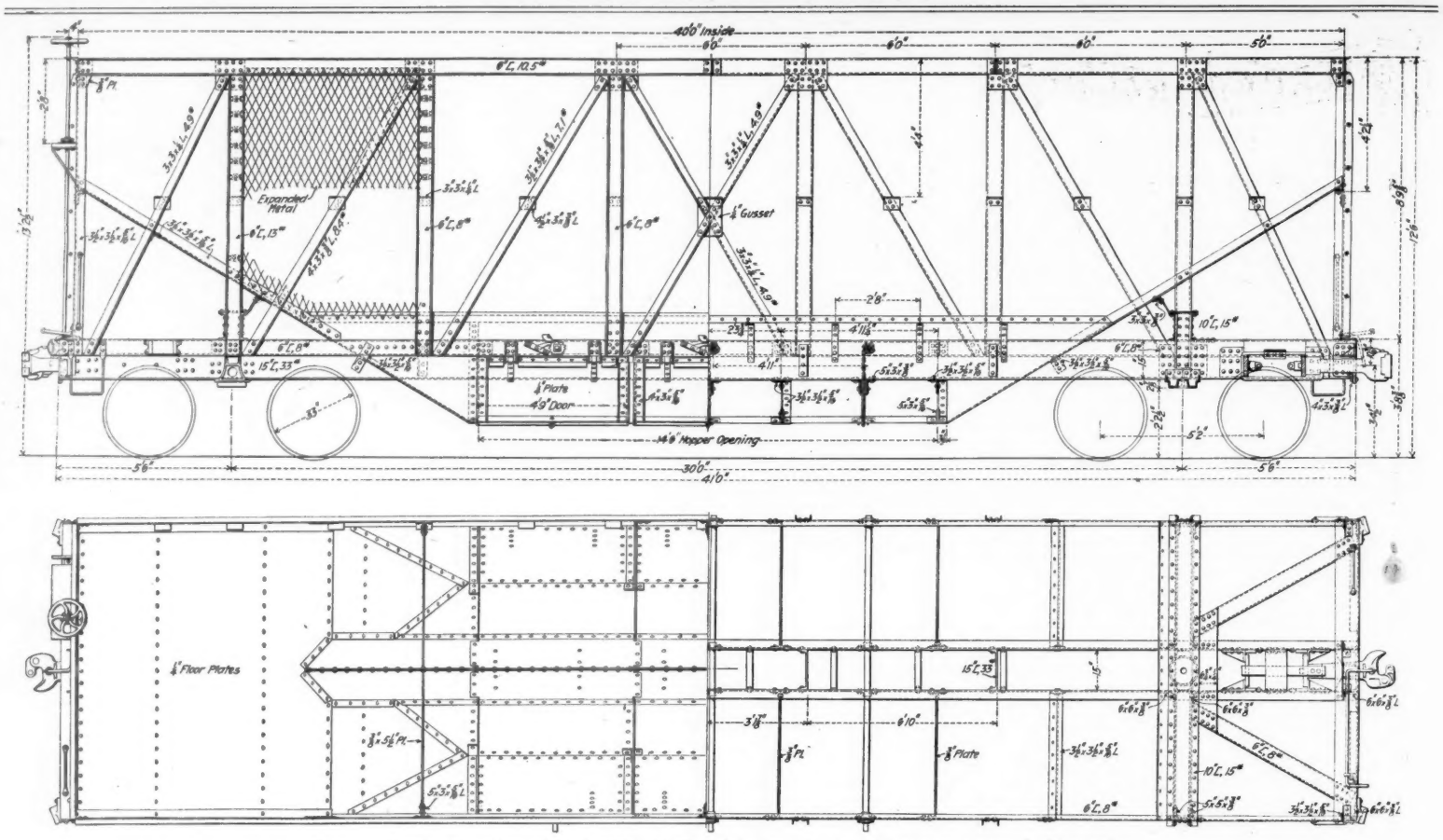
I am, sir, your humble servant,

R. TREVITHICK.

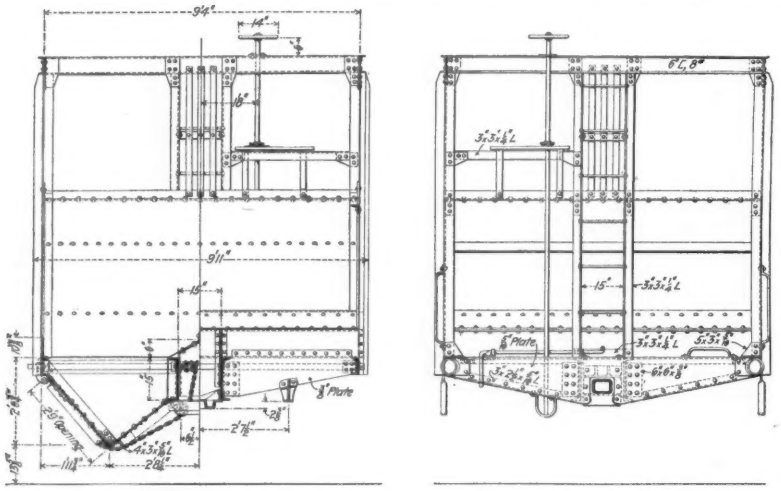
As to the above date, February 15, 1804, was a Wednesday; "last Saturday" therefore means the 11th, and "on Monday" would be the 13th, which is therefore the true date of the centenary of the locomotive. The Mr. Davies Giddy mentioned in this letter was a Cornishman of wealth and position, afterwards for several years Member of Parliament for Bodmin, a small town in Cornwall about thirty miles from Trevithick's birthplace. Later on he took the name of Gilbert, instead of Giddy, and was always a staunch believer in the ability of his distinguished countryman. The celebrated trip of the engine down to the canal basin at Navigation House took place on Tuesday, February 21. As Trevithick himself says, that no water was supplied to the boiler during the run, on which many delays took place, it is pretty plain that the machine virtually ran down by gravity. In fact, the load behind of 25 or 30 tons sent it along. They were coming back very steadily, smashing a tram-plate every few minutes and letting a wheel down on the ground. After a good deal of this trying process a bolt connecting one of the axle sockets with the boiler shell gave way, letting the water run out and, of course, effectually stopping the experiment. The engine had shown its capacity, but it had also shown that the tram-road would have to be entirely relaid with heavier plates before it could do any useful work, and no one was prepared for that. It was dismounted and used to run a planishing mill at Penydaran Works for a time, but apparently was thoughtlessly destroyed at some unknown period.

Late in the same year Trevithick made another locomotive, practically identical with its predecessor, but somewhat smaller, for Mr. Blackett, of Wylam, near Newcastle-on-Tyne. Its cylinder was 7 in. x 36 in., the wheel-base 58 in., boiler of the same type as before, but apparently of wrought-iron. The principal variation was that the cylinder was put at the other end of the boiler, so that the fireman could attend to his work properly. This caused the axle of the driving pair of spur-wheels to pass between the funnel and the boiler end. The machine weighed, full, 4½ tons, and does not appear ever to have been used; no doubt the miserable old wooden tram-road could not carry it. It was employed as a stationary engine in Gateshead, however, for many years.

The only other locomotive Trevithick ever built was one which he exhibited on a circular railroad of small size, laid down upon waste land, near Torrington square, about half a mile south of Euston Station, London &



Plan and Side Elevation of Vanderbilt 50-Ton Coke Car for the Lackawanna Iron & Steel Co.



Section and End Elevation of 50-Ton Coke Car.

North Western Railway, in July, 1808. Tickets to see or travel on the engine could be obtained, price 5 shillings each, at certain public-houses in the neighborhood and of a Mr. Holden, of the British Museum. The trips were to commence on July 19, at 11 a. m., and perhaps did so, but next day they were postponed till the 25th, on account of the softness of the ground. If resumed at all it was not for long, as the venture turned out a dead loss. The advertisement is headed "Racing Steam Engine." It was also announced that it would run at Newmarket in October, no doubt to compare the engine's speed against that of a racehorse, but there is no proof that any such trial took place. The engine had no gear or spur wheels, like the others, a vertical cylinder sunk in the boiler having its piston rod attached to a crosshead from which long connecting rods drove one pair of wheels. Possibly the other pair had a radial axle or other means of easing the running round the small circle. Some guiding power would also have been required if the engine was to race against horses on a common road, and for the same reason tram-plates and smooth wheels were no doubt used in the experiments. It seems unlikely that the expense of a sufficiently long railroad at Newmarket was ever contemplated, but there are plenty of excellent straight level roads there where it might have run very well. The fate of the engine of 1808 is unknown, but it may be termed the first passenger locomotive. All these engines exhausted into the funnel, a discovery sufficient in itself to immortalize its originator. Of the misfortunes of Trevithick's later years this is not the place to speak. It is probable that when, in dire misery and poverty, he met Robert Stephenson in South America in 1827, he communicated to the latter valuable information as to the capacity of the locomotive, which bore good fruit afterwards at Rainhill. Personally, Trevithick was a very tall man, with a plain but intelligent face. He left three sons of whom the second, Francis, was the first Locomotive Superintendent the London & North Western Railway had at the Crewe Works. His 8 ft. 6 in. single engine "Cornwall," named after his native county, and built in 1847, is still running. The third son, Frederick Henry, died only two years ago. He was Assistant Locomotive Superintendent on the Eastern Counties (now Great Eastern) Railway about 1850. Grandsons of Trevithick are in charge of the engines of the State Railways of Japan and of Egypt.

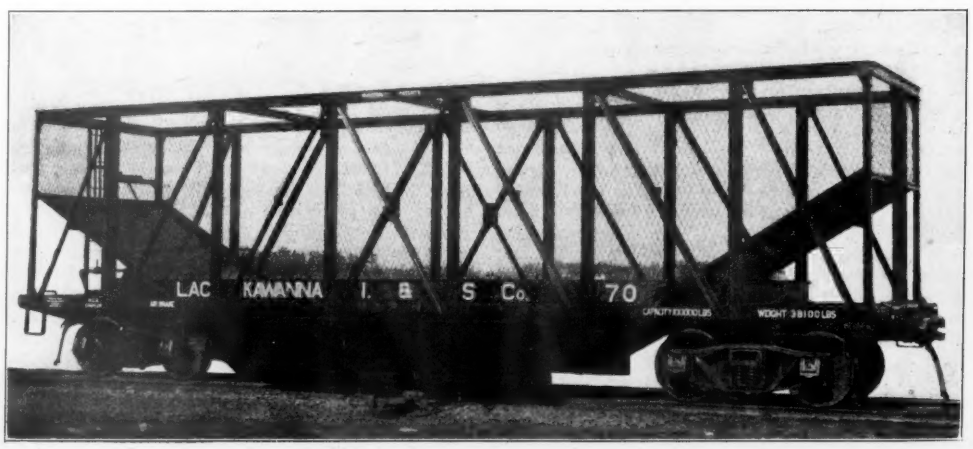
Vanderbilt 50-Ton Coke Car.

The Lackawanna Iron & Steel Co. has recently received from the South Baltimore Steel Car & Foundry Co. a number of 50-ton steel coke cars built after the designs of Cornelius Vanderbilt. They are 40 ft. long, inside, and 9 ft. 4 in. wide, with a cubic capacity, level full, of 3,295 cu. ft., equivalent to 100,000 lbs. of coke at 30½ lbs. per cu. ft. With a 30 deg. heap, the cubic capacity is 3,749 cu. ft., equivalent to 114,000 lbs. of load. The frame was designed to carry a maximum load of 120,000 lbs., so that the margin of safety is quite large.

The load is carried by the two 15-in., 33-lb. channel center sills and by the trussed side frames, which are built in the form of Pratt trusses. Channels, 6 in. x 8 lbs. are used for the bottom chords and intermediate posts except those over the bolsters, which weigh 13 lbs. per ft. The top chord is a 6-in. channel weighing 10.5 lbs. per ft. Angles are used for the diagonals and end posts. The center panel has double diagonals. Gusset plates are used for the connection of the posts and diagonals to the top chord, but at the bottom of the truss they are riveted directly to the light side sills which form the bottom chord. The end sill is made from a flat plate $^5/_{16}$ in. thick, stiffened on the inside face with a 4-in. x 3-in. x ⅜-in. angle, and fastened to the longitudinal sills with 6-in. x 6-in. x ⅜-in. angles. A special casting which acts as a striking block is riveted in between the center sills just back of the end sill, which is cut out around the coupler. The carry iron is bolted to lugs on the bottom of this casting and by removing one bolt the coupler may be dropped out. The center sills are continuous between the end sill and bolster and the draft lugs are riveted on their inside faces with 10 rivets to each piece, front and back. Sessions-Standard, Type C, friction draft gear has been applied to all these cars. The body bolsters are built of two ⅜-in. plates above which are two 10-in., 15-lb. channels extending clear across the car and resting on top of all the sills.

The distinctive feature of these cars is the use of expanded metal instead of plates for the sides with the view of saving in weight. It was furnished by the New York Expanded Metal Co., New York, and weighs 7 lbs. per sq. ft., with a 3-in. mesh. It is secured to the posts with clips as shown in the side elevation and at the top and bottom with a steel strip riveted along the edge. Running steps are riveted on each post and diagonal on the inside of the car. The side frames are prevented from bulging outward by three ⅜ in. x 5½ in. plates which tie the top channels of the side frames together, over the ends of the hopper doors and in the center of the car. The floor sheets are ¼-in. plates.

There are three hopper doors on each side, each 4 ft. 9 in. long by 2 ft. 9½ in. wide, hinged from the side sill with strap hinges hung from brackets riveted to the sills.



Vanderbilt 50-Ton Steel Coke Car.

The doors are stiffened with angles on all four edges. The winding shafts for each pair of doors extend clear across the car but are operated only from one side. The chains wind around the shaft between the center sills and pass down and under a sheave hung in angle brackets from the under side of the center sills to an eyebolt riveted to the stiffening angle on the bottom edge of the door.

The use of expanded metal for the sides of coke cars is a decided innovation and the results to be attained will be watched with interest. The saving in weight over ¼-in. plates is approximately 2,000 lbs., but expanded metal is hardly as capable of withstanding rough usage as plates and the saving in weight will probably be offset with a considerable charge for maintenance and repairs. The temptation will be great to push pinch bars through the open meshes to start the load through the hoppers when unloading. The laborers who will handle these cars at the loading and unloading points are not of a high order of intelligence and will use the method of least work in clearing them, even if this be hammering the sides with mauls or using the meshes of the netting as lever fulcrums. The experiment may prove satisfactory and it may not.

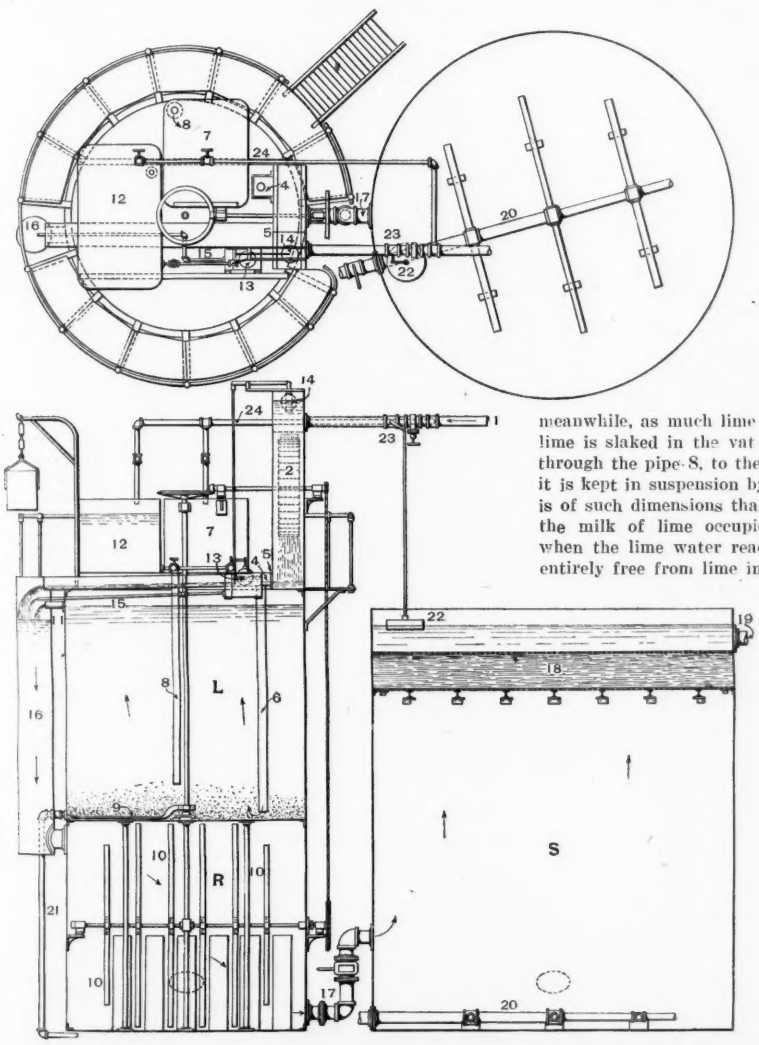
We are indebted to Cornelius Vanderbilt for the drawings and photograph.

New Type of Purifying Plant—Industrial Water Company.

The Houston Coal & Coke Company, having for some time experienced trouble from hard and impure water, has recently installed at their mines and ovens at Elkhorn, W. Va., a water softening and purifying plant. This plant has a capacity for 10,000 gal. of water an hour, and purifies all the feed water for the stationary boilers and mine locomotives, and furnishes the supply used in many residences in the vicinity. The water, which is lifted from a well 450 ft. deep, situated on the property, contains, in addition to 20.81 grains per gallon of calcium and magnesium salts, 2.16 grains of carbonate of iron and a small amount of hydrogen sulphide, which render the water unpleasant to the taste and unfit for domestic use. These impurities as well as the scale-forming salts, are removed by the treatment and a good water is thus obtained, both for boiler feed and general household purposes. The following analyses show how far the purification of the water is carried by this apparatus, using for reagents merely fresh lime and soda ash. As the water comes from the well it is clear and colorless; upon standing, however, the bicarbonate of iron is decomposed by contact with the air, precipitating ferric oxide which makes the water quite turbid. On account of the dissolved iron the freshly-drawn water has a disagreeable taste. After precipitation, by standing, the water loses its sparkling appearance, and much of the disagreeable taste is removed, so that the turbid water is really preferable for drinking purposes. Of course, treatment in the softening plant renders the water not only perfectly clear but free from all residual disagreeable taste.

	Grains per U. S. gallon. Before treatment.	After treatment.
Total residue	34.01	31.81
Silica, SiO_2	0.76	0.49
Iron oxide, Fe_2O_3	....	0.07
Iron carbonate, $FeCO_3$	2.16	....
Calcium carbonate, $CaCO_3$	3.45	1.66
Calcium sulphate, $CaSO_4$	10.88	....
Magnesium hydroxide, $Mg(OH)_2$	....	0.97
Magnesium sulphate, $MgSO_4$	4.74	....
Magnesium chloride, $MgCl_2$	1.74	....
Sodium carbonate, Na_2CO_3	....	1.27
Sodium sulphate, Na_2SO_4	8.52	25.04
Sodium chloride, NaCl	....	2.20
Free carbonic acid, CO_2	1.60	....
Total scale-forming solids	23.73	3.19

The original form of continuous automatic machine comprises primarily three tanks: One for the manufacture of lime water, another in which to accomplish the intermittent mixture of reagents with the water, and a third, usually larger than the other two, wherein the precipitates may settle. In the machine shown in the accompanying drawing, two of the tanks above mentioned—the lime tank and the reaction tank—are included in a single shell, the bottom of the lime tank furnishing the head for the reaction tank, with resulting economy of space over the three-tank machine. Moreover, it thus becomes possible to obtain a lime tank of greater diameter, for a given capacity, than where separate tanks are used. It is plain that the advantage of a lime tank of greater diameter resides in the fact that the upward flow of lime water will be at a slower rate than the flow in a tank of like capacity, but which is of lesser diameter and greater height. This permits the production, always, of clear saturated lime water free from milk of lime. The system of agitators in the reaction tank affords efficient means for thoroughly mixing the chemicals with the water. By the time the water reaches the settling tank it is soft, but carries in suspension all the precipitated iron, lime and magnesium salts that render the water unfit for use in its raw state.



Purifying Plant Built by the Industrial Water Company for the Houston Coal and Coke Company.

The water enters the machine at 1 and passes over the water wheel 2, thereby supplying the power required to operate the agitators 9 and 10. In the reservoir 3, below the wheel, the water is divided into two portions by means of two adjustable gates 4 and 5 in the side of the wheel box. The portion of the water flowing from 4 passes down the pipe 6 into the lime tank L and emerges beneath the milk of lime, through which it rises, dissolving, meanwhile, as much lime as it will hold in solution. The lime is slaked in the vat 7 and is subsequently conveyed through the pipe 8, to the bottom of the lime tank, where it is kept in suspension by the agitator 9. The lime tank is of such dimensions that in spite of continual agitation, the milk of lime occupies its lower portion only, and when the lime water reaches the overflow chute 11 it is entirely free from lime in suspension. The soda solution which is prepared in the vat 12, flows into the regulating box 13, whence the overflow is regulated by a slide valve governed by a float 14 in the upper compartment of the wheel box in such manner that the amount of soda solution fed is always proportional to the amount of water undergoing treatment. After passing through the pipe 15 the soda solution unites with the raw water and the lime water in the mixing pipe 16, through which the mixture is conveyed to the reaction tank R, where it undergoes a thorough stirring for half an hour, thereby insuring complete reaction. From the reaction tank the water passes through the pipe 17 into the lower part of the settling tank S, where the precipitates settle to the bottom, the water flowing slowly upward and through the wood fiber filter 18 to the outlet 19. The filter removes from the water any precipitate which may have found its way to the top, though the upward velocity in this tank is so small that little, if any precipitate ever reaches the filter.

Once in 12 hours the precipitates are drawn from the bottom of the settling tank through the system of drains 20. The spent lime is disposed of through three pipe systems similar to that shown in 21. A float 22, and butterfly valve 23, regulate the inflow of water and since the reagents are always fed in proportion to the amount of water treated, the operation of the apparatus is automatic. The pipe, 24, supplies water to the lime and soda vats whenever the lime is to be slaked or when the soda ash is to be dissolved.

When running at the full capacity, 180 lbs. of lime and 270 lbs. of soda ash are consumed in 12 hours and 580 lbs. of precipitate, consisting chiefly of ferric hydrate, calcium carbonate and magnesium hydrate, is discharged during this time. This plant, which was designed and erected by the Industrial Water Company, of New York, has been in successful operation about four months.

Trade Unions and Employers' Associations.*

BY CHAS. W. ELIOT, PRESIDENT OF HARVARD UNIVERSITY.

The opening of the 20th century has witnessed a remarkable change in the conflict between labor and capital—a change due to a very rapid increase in the effective power of large combinations of men. Democracy has made legal these combinations, whether of laborers or of employers, and applied science has made them possible on an immense scale and over great areas. The telegraph, telephone and quick mail have made it possible to unite thousands of men who live and work in groups scattered all over our broad land, in prompt common action under a few leaders whose headquarters are kept in instant connection with hundreds or thousands of different centers of industrial activity. This secure legal status, which is hardly 30 years old (in England 1871-75), and these means of instant communication, so recent as still to be developing, belong both to workingmen and to employers. The workingmen were the first to utilize them, for till the opening of the 20th century the organization of employers was very inferior, both in extent and in firmness, to the organization of the employees.

RISE OF EMPLOYERS' ASSOCIATIONS.

In most of the trades and manufactures in this country the employers were so imperfectly organized that, by attacking one employer, or a few isolated employers, in a trade or manufacture in which many employers were competing with each other, the labor unions could gradually overcome the whole group by forcing a few at a time to raise wages or shorten hours in fear lest their competitors should capture their business during a strike. It is the frequent sight of this conquest in detail and the mounting demands of organized labor which have finally produced firm associations of employers. The spirit of the numerous employers' associations, which, with characteristic American quickness, have been organized within three years, is not always the same. In some of them the prime object seems to be to resist labor unions; but in most of them the main intention is to discuss with organized labor new demands from either side, to prevent the interruption of production, and, respecting each other's rights, to keep the peace and co-operate for mutual benefit.

An employer or an association of employers may be expected to resist at first new demands of his employees, if these demands threaten to diminish the employer's habitual profit; but if the employees stop working, the employer will not long forego all income from his investments in buildings, machinery and stock. If his market is secure, he will raise the price of his product enough to cover his new expenditures for labor and to keep his own habitual profit—that is, he will, after a time, compromise with his employees, resume operations, and recoup himself from the community. Naturally, an employer who has a practical monopoly in his business will act in this way sooner than one who has not, for he is surer of his market. Now, the final outcome of the successful organization of a solid and complete employers' association in any trade or industry is the securing of a monopoly of the whole product of that trade or industry; and the final outcome of the successful organization and maintenance of labor union is a monopoly of all the labor in the trade or industry which the union represents. Work out to perfection in practice the theory of the complete national employers' association in any trade, and federated labor unions all over the country in the same trade, and we arrive at the successful establishment of two monopolies—one in the labor necessary for making the goods, and the other in the goods themselves.

The fundamental motive and spirit of these two monopolies are precisely the same. Both propose to prevent competition, so that each may regulate prices within its own field. The workmen propose to get into the union all the laborers in their trade, so that they can control the daily wages, the number of hours or of pieces of work which shall be called a day, and the general conditions under which the work is done, the definition of a day's work being the basis of the demand for extra pay for overtime. The employers propose to fix the conditions under which the whole product of the industry shall be sold to the public. The strong employers' association, which at the start may have been an organization chiefly for defense, inevitably tends to become a means of establishing a monopoly, or, at least, to become a price-raising or price-maintaining agency, and every national or international labor union is trying to determine all the conditions of labor, pecuniary and other, for every laborer in the industry it represents, or, in other words, is trying to establish a successful monopoly of the sale of a certain kind of labor.

EMPLOYERS AND EMPLOYEES' AGREEMENTS.

The new feature in the industrial conflict since the 20th century began is this—one monopolistic combination, the union, nowadays finds itself in face of another, the employers' association. This kind of encounter, which was rare, is now common. Out of it has promptly come the joint agreement. This joint agreement between a labor union, or group of unions, and an employers' association

*From an address to the Boston Central Labor Union.

is a very important step in the development of the conflict over industrial conditions, and it is of the utmost consequence that the general public should understand its significance. The firm labor union, or group of firm unions, makes an agreement with a firm employers' association—an agreement which ordinarily covers a period of from one to three years; in this agreement are included wages, hours and elaborate provisions for the discussion of differences and the settlement of disputes in conferences between the two parties and for arbitration when conflicts fail to reach a satisfactory settlement by direct conference. The employers agree to employ only union men and the union agrees that its members shall work only for members of the association, and thus the employers accept and give effect to all the restrictive regulations which the union imposes on its own members.

The plain tendency of the joint agreement is to bring about a junction of the forces of labor and capital in the combined effort to raise prices and so increase both wages and profits. The ultimate result has been reached in several trades or industries in the United States within the last three years. It is not an original or novel idea. Just such results were aimed at in the combination called the Birmingham alliances in England, which date from 1890. These alliances included a pledge on the part of the manufacturers not to employ any but members of the operatives' association, and on the part of the operatives not to work for any but those manufacturers who sell their goods at prices decided on from time to time by a "wages board, to be formed of an equal number of employers and employed." The two parties united their forces in order to exact better terms from the community for their trade as a whole, and incidentally to protect themselves against what they considered unfair competition. It is this idea which has been rapidly carried into practice on a great scale among our own people since the 20th century opened. The dual combination of laborers with employers is sometimes strengthened by including an association of manufacturers of the supplies which the employers in the trade concerned make use of. The three bodies acting together are capable of exercising a complete command over the trade so organized; but they have great difficulty in acting together except in very prosperous times.

Whither does this practice tend, and what are the natural limits of its power, if any there be? Under democratic law and custom and with the facilities which modern society possesses for quick intercourse and free exchange of views, these two monopolistic combinations, the union and the employers' association, have come into existence, and are capable of uniting in a common interest. What is the limit to the successful exercise of the tremendous power such a combination of two monopolies possesses? The limit, I believe, is only to be found at the limit of the consuming power of the population. That consuming power is limited. It fluctuates from year to year, but it rises in civilized countries from generation to generation, and has risen prodigiously during the past 100 years. Nevertheless, its limits are much narrower than the modern monopolists appear to suppose.

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SOME GAIN TO THE COMMUNITY.

There is, however, some clear gain to the whole community from the progressive rise in the prices of labor and of materials since labor unions began to put up wages. Invention has been strongly stimulated thereby—the invention of labor-saving machinery and of new materials or new combinations of materials. Every such invention adds to the power of man over Nature, and some of this added power ought to be credited to the unions. At this point some enthusiastic unionist may say, organize every trade and calling, so that there shall be no non-union public to suffer from the price-raising which 20th century unionist effects. But if we try to imagine the entire community divided into trade union groups, each group containing the union and the employers' association of its trade, we immediately perceive that the attitude of each single trade group toward its consumers will remain precisely what it is now. Society will be divided into monopolistic trade groups; but each group will be trying to get higher wages and profits by raising prices on its own goods. The union label will be on all goods, and therefore of no advantage to any, and the only market will be a higgling between intrenched monopolies. A demand consisting of many unionized monopolies will encounter a supply proceeding from a single unionized monopoly. This situation is almost unimaginable.

THE COST OF RESTRAINT OF TRADE.

Recent experience and the ordinary working of universal human motives assure us that these combined efforts of two monopolies may be directed, and will be directed, to raising the prices of necessaries of life, such as coal, wheat and water. From real necessaries of life the people at large cannot long abstain, although in some measure they can find substitutes for things they have considered necessaries. People can wait for cigars or cash registers, or even for houses and shops; but they cannot wait long for food, or domestic fuel, or in cities, for the water which must be pumped by coal, or for the street lights produced from coal. Already in the United States the supplies of these necessaries of life in modern society have been seriously threatened, and indeed for brief periods partly cut off. From such dangers society must find a sure way to defend itself. The total interruption of the post-office, telegraph or telephone service, or municipal water supplies is not to be contemplated by modern society. Other modes than strikes or lockouts must be used for adjusting wages and hours of labor in such services as these. All possible alleviations and defenses being taken into account it must be confessed that the prospect of encountering a combination of a perfect labor union and a perfect employers' association, both engaged in providing a necessary of life, and both bent on raising its price, is a formidable one for society at large. Democratic society has by its legislation and by its public opinion made such a combination possible, and democratic society must guard against dangers which, in its pursuit of liberty, it has engendered.

It is, of course, conceivable that the Legislatures which created the right of association should hereafter limit that right, or restrict the purposes for which the right should be exercised. It is also conceivable that the courts should find ways of preventing that close restraint of trade which results from firm monopolistic organization, whether that of a labor union or of an employers association, or indeed of a very comprehensive trust among owners of railroads, steamships or factories. Much of the old doctrine about conspiracy and restraint of trade seems to be in an uncertain and latent condition; but it is possible that this doctrine may be revivified and developed by democratic courts and accepted by the democratic society. The world has already seen the disappearance of monopolistic industrial organizations which once had great power.

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GOVERNMENT INSPECTION AND CONTROL.

The same democratic government which gave the right of association and the right of incorporation with limited liability has already exercised some powers of supervision over the strong combinations thus created, especially when the industrial combinations created began to exert a monopolistic power. Thus railroads, steamship companies, gas companies and electrical companies of all sorts, with banks, savings banks and insurance companies, have been made subject to various degrees of public supervision, and this public supervision commands, in most respects, public approval and has produced, where wisely exercised, admirable results in the protection of the public against monopolistic oppression.

The present tendencies of labor unions and employers' associations suggest strongly the expediency of establishing over them governmental inspection and control, and this for two reasons—first, that both kinds of association soon become monopolistic, and secondly, that they are secret societies. Democratic government, like despotic government, dislikes secret societies, particularly if they are apt to resort to violence for the enforcement of their demands. Americans seem to take kindly to private or secret clubs or associations for social and benevolent purposes, and now and then for political purposes, but they are inclined to distrust the organization of thousands or millions of men into secret societies having industrial or commercial objects. One would say that, on the whole, there has been a visible tendency during the last four years to an increased regulation of industrial combinations of all sorts through the courts.

Picketing is sometimes prohibited by police orders, on the ground that, like assembling in crowds on the streets, it causes public disorder in times of excitement. The growing strength of industrial combinations having been partly expressed in the accumulation of invested funds and cash resources, the tax gatherer is looking at these accumulations with increasing interest. Moreover, these accumulations invite actions for damages against either labor unions or employers' associations—actions which may be brought by an injured workman or an injured employer, or by the public prosecuting attorney.

The action of legislative or judicial remedies must, however, necessarily be slow and superficial. The real remedies for destructive strife, whether the strife between workmen and capitalists or the strife between firm monopolies and society at large, must be found through the deep workings of the same democratic spirit which created the conditions that made such strife possible. Now, the effective democratic powers for good are the increase of intelligence and skill through education, and the increase of efficiency through the promotion of individual liberty and co-operative good will. How to develop these powers is democratic society's great problem.

Real social improvement or progress is very seldom brought about in this world by violence, although violence seems to be sometimes necessary in order to procure public attention to existing wrongs, and to win opportunity for the play of reason and good feeling. There is no more misleading phrase in history than the phrase "decisive battle." Waterloo has been called a "decisive battle," and it did restore the Bourbons for the moment; but somehow there has now been a republic in France for a whole generation, and the president of it is of peasant birth. How many things my generation thought were decided at Appomattox; but during the subsequent 40 years it has gradually appeared that hardly anything was there settled except the preservation of the unity of the national territory. It remained for long years of civil endeavor to determine the uplifting of the negro race, the relations of the whites to the negroes, the new industrial resources of the South, and the slow development of a better social order. That frightful civil war did but procure the opportunity for the legitimate play on a great social wrong of the universal principles of good feeling and good sense.

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RISING WAGES AND PENSIONS.

Two other humane conditions of labor, if generally introduced, would render industrial conflicts less frequent and greatly mitigate their severity. These are the rising wage—rising, that is, with years and experience—and the pension or retiring allowance at disability. I see with great satisfaction that these two provisions, both of which prevail in my business, are spreading widely among industrial, financial and transportation companies in the United States. Wisely applied and taken together, they are capable of doing much to prevent strikes and other disastrous interruptions of manufacturing and trading operations. They give security and dignity to the laborer, and are as applicable in the humblest careers as in the highest.

These processes of improving the conditions of labor by giving free play among laborers to the ordinary hopes and motives which govern the conduct of all intelligent and conscientious people are in the main within the power of any single employer, and should be examined, not as philanthropic performances, but strictly as business measures. It has been abundantly proved that what are called "welfare" arrangements in factories—good air, strong light, cleanliness, tidiness, ornamented grounds, washing facilities—lunch-rooms and so forth—emphatically pay. They are not favors or charities, but business. Just as the single employer or owner, whether an individual or a corporation, can introduce these welfare arrangements of his own motion, so he can adopt all the humane conditions of employment I have described, with the single purpose of making his business steadier, more agreeable, and, all things considered, more satisfactorily profitable. These humane conditions, wisely adjusted, will pay, because they will make all hands more alert, zealous and efficient, more contented and happier, and therefore more productive workers.

NEW OBJECTS OF ASSOCIATION.

You have doubtless perceived that an organization of industries under the humane conditions which I have been describing involves the continued existence of both kinds of industrial association—the employers' associations and the labor unions—but the motives and objects of both these associations would be much changed. In industries which support thousands of workmen and hundreds of employers, both workmen and employers often need to take action through representatives, and must maintain organizations capable of choosing representatives. Apart from benevolent and social objects, those two forms of association would be maintained for the principal object of determining prices—the prices which each industry would bear. A secondary object would be to improve steadily those sanitary and educational conditions of labor which make labor more efficient and both capital and labor more productive. Those two objects are perfectly harmonious, for since wages can in the long run only be paid out of product, the economic justification of higher wages is greater skill and efficiency in the individual workman, and their social justification is the increased total efficiency and happiness of the community. The process of determining what prices a given industry will bear is now a process of combat. The weapons have been chiefly strikes, boycotts and lockouts, all of which ordinarily involve bitter strife and violence, and not infrequently the disastrous interruption of a productive industry. This is certainly a very stupid way of arriving at a determination of the best price to be got in any year or at any moment for a given product. Conference and discussion between the workman, the capitalist and the trading agent, whatever he may be called, are the rational modes of arriving at a practical answer to the question of price; and this would be the mode adopted if right relations existed between capitalist and workman, each believing that the other had a genuine interest in the real success of the business they unite to conduct.

Democratic society believes fundamentally in seeking the greatest good of the greatest number, and in seeking this greatest good through freedom, order, justice and good will. During the first half of the 19th century it believed that the greatest good of the greatest number was consistent with the greatest good and largest freedom of the individual. During the last half of the century it seems to have experienced some revulsions of feeling with regard to personal liberty. It has seemed willing to sacrifice the welfare of the individual to the supposed welfare of the mass, to abridge the liberty of the individual for the supposed collective benefit of his class.

The labor unions and the employers' associations both illustrate this tendency. They are both fighting organizations, and all fighting abridges individual liberty—indeed, puts an end to it for the time being. Armies and navies are not concerned with personal liberty, but with implicit obedience and the complete subordination of the individual to the efficiency of the organization to which he belongs. In the same way labor unions and employers' associations, so far as they are fighting bodies, abridge personal liberty, and so far forth they are in conflict with the democratic ideal. They are also in conflict with the democratic ideal when they destroy free competition. In this respect one kind of association is just as bad as the other. A monopoly has always been an object of detestation in democracies, and such it ought always to remain, for competition is the native air of human progress and improvement.

DEMOCRACY AND THE LABOR QUESTION.

How else can the new and better thing get a chance to demonstrate its superiority to the established but inferior thing? How else can rising genius win its way against intrenched dullness? How else can new inventions in industry or trade demonstrate their superiority? The rising generation should be free to compete with the generation in possession. The young journeyman should be free to compete with the old one, and surpass him if he can. The department store should be free to prove that it serves the community better than a large number of separate stores. A young department store should be free to prove itself better than the older ones. Competition in industries, trades and professions provides the indis-

pensable opportunity for progress. It is the friend and servant of liberty, and this is the reason why democracy has always feared and protested against monopoly.

Again, democracy believes to its very core in the modern mobility of industrial and commercial society, that mobility or fluidity which permits the capable and promising individual to rise through its various layers. It believes with all its might that every young American of remarkable capacity should find it easy to rise through all the grades of his trade till he becomes himself an employer and leader. It believes with all its soul that every child should be able to get the best education it is capable of receiving, and that society suffers a grave injury if the upward progress of a promising child is checked or prevented.

Democratic society, therefore, sees with great concern that in the joint agreements now made between labor unions and employers' associations there are many provisions which tend to make rigid and high the barriers between the common laborer, the helper, the journeyman, the employer and the capitalist, and the fences between one trade and another. It sees with alarm these great combinations of men acting on principles which tend strongly to divide American society into classes, and to perpetuate those classes. Whoever gets a monopoly—be it one man or 100,000 men—invariably tries to keep other people from sharing his exclusive privilege.

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A WORLD-WIDE CONFLICT.

How, then, shall democratic society contemplate these new and formidable industrial and social commotions? Calmly and courageously, as witnessing a world-wide conflict in which certain democratic qualities of ancient date are greatly needed, and are to be ultimately manifested. These qualities are an abiding confidence in freedom, publicity, discussion and fair play, a love of vigor and efficiency and a firm faith that free institutions will prove to be also fundamentally righteous, and consequently conducive in the highest degree to public welfare and happiness. Amid all these combinations and masses, what can the individual do, the man of free spirit, who is willing to pay to-day's price for freedom? You and I and everybody must, in the first place, believe, and must teach our children to believe, that brave men are not mere creatures of circumstances, slaves of blind forces, or tools of destiny, but are capable of molding circumstances, directing forces and changing destiny. And then each one of us might fight evil and promote good by his own personal endeavors and sacrifices. The forces of society, which seem so strong, often turn out to be weak when confronted by men who believe with all their hearts in pure ideals of freedom and righteousness.

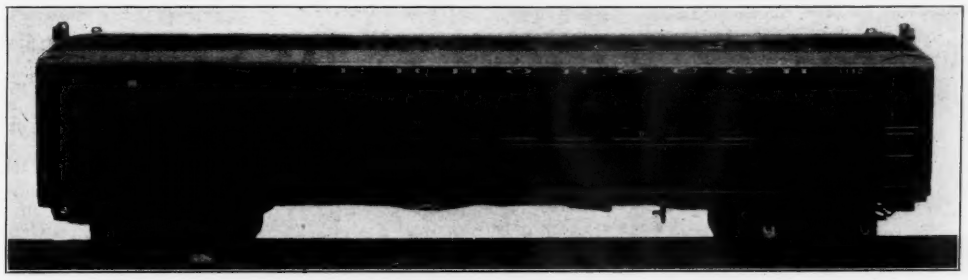
Steel Cars for the New York Subway.

The Interborough Rapid Transit Co., operating the elevated and subway lines in New York city, has ordered from the American Car & Foundry Co. 200 all-steel passenger cars for the subway which differ radically from any other cars previously built. With the exception of the end doors, window frames and sash, no wood will be used in their construction. An experimental car was built in the car shops of the Pennsylvania at Altoona last year which was put in service on the Second avenue elevated line for a thorough test on Monday, Feb. 8. The accompanying photographs show the appearance of the finished car and the general construction of the skeleton framing. While the experience gained in building this first car has resulted in numerous changes in the design of the cars about to be built, the latter will follow closely the same general lines as those embodied in the experimental car. The principal changes have been in reducing the weight by substituting lighter sections wherever possible without sacrificing strength.

The underframe is made up of channel center sills and plate girder side trusses formed by the light side sills, the ⅛-in. steel plate sheathing and the belt rail under the windows. The window posts are channels, carried down to the bottom of the side. These cars have the same type of vestibule platform as the copper-sheathed cars now running on the Second avenue elevated but which will be used in the subway when it is opened for traffic. Because of the greater stiffness of the whole car, however, it has been possible to lengthen the platforms somewhat without decreasing their strength in buffing. The seating arrangement will be similar to that used in the present elevated cars, there being the usual longitudinal seats at each end with eight cross seats arranged back to back in the center. The seat frames will be made of pressed steel and the coverings of rattan. The interior finishings will be of aluminum. Pressed steel ceiling linings are to be used and a heavy steel floor laid over the sills. Asbestos lagging is put in wherever possible to deaden the noise and no complaints are expected from that score, as the car now in service rides quite as silently as any of the wooden cars. Every precaution has been taken to prevent short circuits, and there is no danger anticipated from such a mishap.

The cars are to be run in five-car local trains and eight-car express trains. In the local trains there will be three motor cars and two trailers and in the express trains five motor cars and three trailers. Each motor car will be equipped with two 200-h.p. motors, one on each axle of one truck only. This gives the express trains 2,000 h.p. available for accelerating an eight-car train.

The general dimensions of the cars are as follows: Length over body corner posts, 41 ft. ½ in.; length over platforms, 51 ft. 2 in.; width over sheathing, 8 ft. 7 in.; maximum width at window sills, 9 ft. ½ in.; width at eaves, 8 ft. 8 in.; height from under side of sill to top of plate, 7 ft. 1 in.; height from top of rail to top of roof, 12 ft.



Side View of Completed Experimental Steel Subway Car.

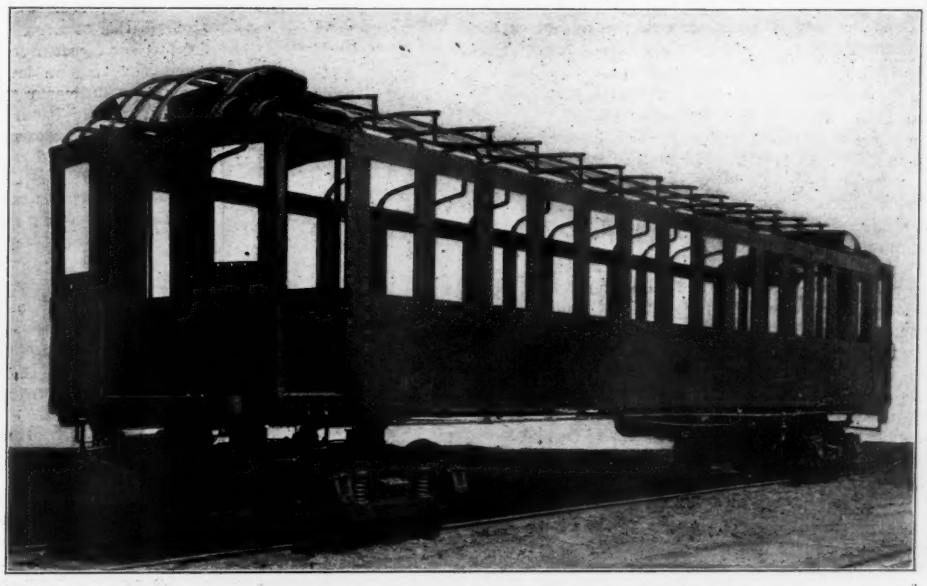
The 200 cars in this order are to be built at the Berwick (Pa.) works of the American Car & Foundry Co., and will be delivered in time for the opening of the subway. The copper sheathed cars already ordered will not be displaced by the new design of car but will be put in service at the same time.

We are indebted to Mr. George Gibbs, Consulting Engineer for the Interborough Company, for the photographs and information.

Problems in Transportation by Rail in the United Kingdom.*

The early forms of railroad carriages and wagons were modeled upon the stage coach and road wagon of the early part of the 19th century, and it is rather remarkable that the curved sides of British railroad carriages are a survival of these old institutions. The origin of the curved side is due to the aim of the designers of the old road coaches to make the body as wide as possible while retaining the spread of the wheels to the width necessitated by the narrow roads—hence the body of the vehicle was curved inwards at the lower panels so that it could be slung in between the wheels; and this peculiar and expensive feature has, with slight variation, been retained in our railroad coaches to the present day.

The early form of mineral wagon consisted of a box superstructure mounted upon a separate underframe, which was carried upon two axles; the capacity of this wagon varied from six to eight tons, and the tare weight from 5½ to 6 tons—except for elaboration of detail this early type has been retained upon British railroads for the last 50 years. Attempts at intervals have been made to introduce variations and improvements in design, and originality was shown by T. Henson, who made a departure from existing practice by introducing on the London & North Western as far back as 1852 wagons built of iron, carried upon a composite iron and timber underframe. These early examples of iron bodies were, however, lacking in stiffness, and, with few exceptions, the design of goods wagons has remained constant for the period mentioned, progress being limited to improvements of detail and the enlargement of structural parts.



Skeleton Framework of Experimental Steel Car for the Subway, New York.

In the early days of railroads, in fact well on into later years, no investigation was made into the question of the proportion which the height and width of rolling stock should bear to the distance between the rails. When the underframe is mounted directly upon the axles it is convenient for the center line of the sole bars to be vertically above the middle of the journals, in order that the springs and axleguards may be attached in the simplest manner; the sill of the side is usually bolted to the outer face of the sole bar, hence it follows that with this system of construction the width over all cannot to any considerable extent exceed the transverse distance between the centers of the journals. The latter dimension is about 22 in. wider than the gage of the road; rigid adherence to a rule of thumb method of construction resulted in the width of the vehicle being allowed to exceed the distance between the rails by not more than 40 in.

It is one of the greatest misfortunes to British railroads that attention was not given to this subject years ago, for, although the load gage upon main line has been gradually increased, such increase has been obtained at considerable expense by setting back permanent structures and increasing the distance between adjacent lines of rails—and even now there is an entire lack of uniformity in the matter. In a contribution on "Standard Load Gages on Railways," to the Minutes of the Proceedings Inst. C. E., our former president, Mr. J. R. Fletcher, M. Inst. C. E., draws attention to the difficulty of dealing with the free interchange of the rolling stock of different companies, and the attendant risks when handling loads of abnormal width. He also points out that there are records of 146 variations of load gage and suggests that railroad companies should adopt a uniform standard.

Too much stress cannot be laid upon this important feature in railroad economics. It must be borne in mind that anything in reason, as to speed and size of vehicle, is possible on our normal rail gage of 4 ft. 8½ in., if we can obtain a corresponding normal load gage. Our present maximum width of main-line rolling stock is 9 ft. 3 in. for passenger coaches, and 8 ft. in the case of goods and mineral stock. Contrast these proportions with those existing upon some of Colonial railroads using the narrow rail gage of 3 ft. 6 in. In the case of the Natal Government Railways, the maximum width of rolling stock is 8 ft. 9 in., or only 6 in. less than the extreme width allowable on English railroads. If our load gage bore a similar proportion to rail gage we should be able to build vehicles 12 ft. 6 in. in width.

There is no doubt that lack of appreciation of the relationship between rail and load gage led to the introduction of the costly 7 ft. gage in this country, for it was maintained that a commodious carriage body necessitated a wide rail gage; and for the same reason the 5 ft. 6 in. rail gage was introduced into India; and such a gage is far in excess of economical requirements, inasmuch as the maximum width of vehicle allowed in that country is about 9 ft. 6 in. On the Continent, though the prevailing rail gage is the same as our own, there is a more liberal proportion of load gage; the author's firm has recently designed mineral rolling stock for use on Continental railroads the width of which exceeds by 25 per cent. the maximum allowed on similar vehicles in England.

Increased width of rolling stock means increased earning capacity, and for many years to come English railroads will have to face the expense of gradually increasing the load gage until it approximates more closely to the conditions existing in America and on the Continent. Traders' sidings, works and collieries will have to be more closely watched, and measures taken to prevent the building of permanent structures to within a few inches of existing rolling stock. No allowance has hitherto been made by traders for the probable introduction of improved rolling stock, consequently they complain very strongly when called upon to provide unlooked for accom-

*Presidential address delivered before the Newcastle-on-Tyne Association of Students of the Institution of Civil Engineers, by George Harrison Sheffield, A. M. Inst. C. E.

modation, which very often necessitates alteration to existing terminal arrangements.

About twelve years ago the author read a paper before this association on "The Construction and Efficiency of Locomotive Boilers;" he pointed out that what little improvement had been made in the capacity of locomotives, up to that time, had been devoted to express engines, and that goods and mineral engines had remained constant in their proportions for 25 years—the same remark applied to rolling stock, for, though two of our principal railroads had for some years previously adopted the bogie system for passenger carriages—which is now generally recognized as the safest and most comfortable medium for transit at high speeds—the movement in many quarters was not looked upon in a favorable light. In fact, 15 years ago a railroad in the south of England ordered some bogie passenger carriages, of quite normal dimensions, for their express trains; these carriages were built in the Midlands, and, in being consigned to their destination, it was necessary for them to pass over another company's system. Incredible though it may sound, the locomotive department of this particular railroad condemned these carriages on the ground that, as they were carried on bogies, they were not safe to run upon the railroad; but after a considerable amount of pressure had been brought to bear by the traffic department which had secured the consignment of these carriages, and were afraid that a competitive railroad, which had for many years used bogie stock of their own, might step in and secure the fruit of their labor, the locomotive department reluctantly gave consent to run them, and insisted upon the carriages being conveyed by slow goods train—a further precaution being taken to fix upon each vehicle a conspicuous card to the effect that they were not to travel at a greater speed than 20 miles an hour. The carriages arrived at their destination safely, and were immediately put into express service. This incident is related merely to show how closely prejudice and ignorance are akin.

In the designs of mineral and goods wagons we have for many years in this country followed a standard practice of building the greater portion of such stock in timber, although a limited number of these vehicles have been made with combined steel and timber underframes, also with all-steel frames and timber bodies; but such combinations have not answered as well as an all-timber frame, owing to the corrosion of the steel, which, being in close proximity to the timber, is inaccessible for painting; this fault is in a measure due to the underframe not being properly designed for the purpose. All-steel wagons have been in use on the Continent for 30 years, and in that time have lost only from 6 to 8 per cent. by corrosion.

For many years previous to the introduction of large steel cars, the leading railroad companies in America used wagons of 20 and 25 tons capacity, together with locomotives of a corresponding hauling power; and in this connection it is as well to note that the minimum capacity, looked upon as obsolete in the States, is now proposed as the maximum capacity for this country. The progressive managements of the railroads in America had recognized that the cost of transporting freight by rail was diminished by increasing the hauling power of the locomotives, and increasing the capacity of the wagons.

The propriety of this policy was clearly indicated by the analysis of the cost of working with the respect to the rational units of the passenger mile and ton mile. These units govern the earnings and should therefore form the basis of getting at the costs. This policy was entirely different from the one pursued on English railroads, where the practice has existed for half a century of increasing the train mileage *pari passu* with the tonnage carried—in other words, each unit of engine power and each unit of train has remained constant in capacity, and the numbers have been increased to suit the conditions of traffic. An instance at point is the Midland Railway, which conveys several millions of tons of coal from the Midland counties to London every year; this traffic has grown considerably during the last 20 years, and to accommodate it has necessitated the doubling of the railroad from Kettering to London. The standard coal train upon this railroad 20 years ago consisted of a six wheels coupled locomotive with about 1,150 sq. ft. of heating surface, hauling 34 to 36 8-ton trucks and a 10-tons brake van; this same unit, with little variation, is the standard to-day, and unless steps are taken to put an end to the multiplication of such units, as the coal traffic increases it will be necessary within the next few years to treble the railroad accommodation between the two points already referred to.

The serious increase in the cost of the traffic and other departments of our railroads, and the feeling of uneasiness among influential shareholders at the falling off in dividends, and the enormous depreciation of what had hitherto been looked upon as a sound security, recently led to an investigation of the merits of railroad working in America, and in a few, a very few, progressive quarters it was discovered that, with modifications, certain features of American practice might be adopted in this country. As is very often the case, there was an anti-climax, and an immediate demand on the part of a body of reformers, whose enthusiasm was more in evidence than their knowledge, for the general adoption of American methods, regardless of the difficulty of changing a crystallized system with 50 years of consolidation at its back. Unfortunately the retrogressive portion of our technical and financial press seized upon the views advanced by the band of enthusiasts as an excuse for heaping ridicule upon the whole movement, irrespective of the merits of any modifications. The result led to an amount of controversy which has been a source of amazement to those interested in a common-sense view, and possessing a knowledge of the subject.

The difficulty of reform on the railroads of this country is due in a measure to conflicting and vested interests which are antagonistic to any alteration in existing arrangements. One such interest consists of many private owners of rolling stock who let out their vehicles on hire—encouraged originally by the railroad companies to do so—and who view with alarm the probability of depreciation of their stock, through the general introduction of modern methods of transport. Further, there is the difficulty of dealing with sidings and terminal arrangements in many traders' works and collieries, where it is contended that, if expenditure is entailed in the alteration to these terminals to suit high capacity rolling stock, the railroad companies should be prepared to grant a reduction in freight rates. If this view had been general in the North of England, the North Eastern Railway would have had the mineral lines on the Northern Division packed with obsolete chaldron wagons for in 1873 the export coal shipped at the ports in Northumberland and Durham amounted to 6,080,870 tons, and there were in use on the system 20,306 chaldron wagons, each of four tons capacity, and weighing about 2½ tons. The coal traffic shipped at the same ports in 1902 had increased to 16,420,637 tons, and there were only 1,447 chaldron wagons in use on the system. It is interesting to note that for nearly 30 years the North Eastern has built only coal wagons of 10½ tons capacity, which is 25 per cent. in excess of the standard coal wagon on British railroads; during the past two years the capacity of the standard wagon has been increased, first to 15 tons and latterly to 20 tons.

A number of important and progressive traders have given careful consideration to the question of improved rolling stock, and for some time have been prepared to launch out into a considerable expenditure to obtain the class of vehicle which suits their terminals and is of a labor-saving order. The concerted measures recently taken by the railroad companies, through the medium of their Clearing House Committee, which has been entrusted with a question of a scope too large to be dealt with departmentally, is of a nature to check further progress in the direction of encouraging traders to co-operate in one of the greatest economical movements upon railroads since the introduction of steam.

It is, of course, desirable that the railroad companies should lay down certain standards of strength, with which all privately owned vehicles must comply, and that they should demand interchangeability in those details of perishable parts which are liable to require renewal when on the road. But they place a heavy tax on progressive industry when they go beyond this and endeavor to tie traders down to the use of certain detailed designs which, though doubtless good from their point of view, are not economical in the matter of first cost or in manipulation at terminals, and these are the points which, before all others, are of importance to traders. A direct result of this action on the part of the railroad companies is that, whereas our competitors in France and Germany are now commencing to deal with their minerals in self-discharging wagons of high capacity, our Clearing House Committee does not at present propose to allow private owners of rolling stock to use such wagons in this country.

To our American cousins, with their freedom from precedent, we are indebted for leading the way in developing electric traction; and, though up to within recent years we have been hampered by legislation and municipal opposition, we may safely claim to have turned the corner, and are now making progress rapidly. In fact, so rapid has been the progress of electric tramways in our industrial centers, and so closely are they competing for suburban traffic, that the only alternative left to the railroad companies is, either to electrify all their suburban lines and so increase their train service, or abandon the greater part of such traffic and leave it to the tramways, reserving only that portion which suits their main line connections.

We are vaguely told from time to time that we are upon the eve of a great change, and that enormous strides will be made in electric traction within the next few years. Such a statement reduced to a plain fact means this—if our railroad companies decide to make a fight to retain their suburban traffic and compete with the tramways, not only in frequency of service, but also in rate of passenger fares, then we shall indeed see a great change, which will involve on a conservative estimate the expenditure on part of the railroad companies of about fifty millions sterling—not a pleasant prospect for shareholders who have for some time been complaining of the raising of additional capital to meet the cost of developments which do not in many cases yield a proportionate increase of net revenue; but it is possible that increased attention may now be devoted to economies which may be effected in other branches of traffic, and to the policy of charging the betterment of existing lines wholly to revenue. Such a step upon the part of the railroads will mean that we shall see greater progress in electric traction within ten years than we have seen in steam traction during the last 30 years, and for this reason they will take up electric traction not from choice but of necessity, and always like a haunting specter will be the tramway running in parallel.

Healthy competition will form a stimulant and help to develop a certain amount of latent ability, but there is one feature in connection with railroad versus tramway competition which is not healthy. Reference has already been made to municipal opposition, and this was very marked under the early Tramways Act of 1870, and is also a natural result of the control of such enterprises by a mixed body of men, who may have no special aptitude or qualification, and who require to be laboriously educated by repeated object lessons based upon precedents established in more progressive localities. But recently the corporations of our large towns have taken in hand (without much regard for cost) the installations of extensive electric tramway systems, and these are running in competition with the railroads. We have here a case of the unequal incidence of taxation. These schemes, even if they do not entail a direct contribution from the rates, are supported and financed upon the security of the ratable value of the property under control of the local authorities, to which value the railroads contribute a very liberal share. Consequently there arises the iniquitous anomaly of the railroads having to support a system which filches their traffic, and without any redress. An instance at point is the case of the North Eastern, which lost during the last half year one million passengers in the Newcastle district and over £7,500 in receipts. Complaints have been delivered *ex cathedra*, but no steps appear to have been taken to oppose this unjust arrangement, and the solution of the difficulty lies in the railway companies obtaining legislative measures to relieve them of that portion of local taxation which is applied in support of municipal tramways.

Although the installations at present in course of construction upon several suburban railroads in England are viewed with a certain amount of suspicion, and in some quarters are looked upon as being largely of an experimental nature, their eventual success will be beyond question. Concentrated traffic worked within a comparatively small area undoubtedly lends itself to more economical handling than at present obtains with a locomotive.

On the vexed question of the third rail, as compared with overhead contact, a few words will not be out of place. The whole matter resolves itself into a compromise between the permanent way and the electrical engineers, and local conditions enter largely into the matter; of the two systems the overhead is the cheaper, inasmuch as many of the difficulties at junctions are avoided; on the other hand, variations in levels, due to negotiating bridges and tunnels, militate against its use in the eyes of the permanent-way engineer. The third rail has been definitely accepted for the several schemes at present under construction; and as the overhead contact answers so well for tramway work, there is no reason why it should not receive a trial on suburban railways.

At the beginning of this year the total mileage of electrical tramways, including tube railroads, in operation in this country amounted to about 1,256 miles, and the greater portion of this mileage has been brought into operation within the last five years, and devoted entirely to passenger traffic. In this connection it is interesting to note the amount of work done by an ordinary electric tramcar during the day. Recently some experiments were carried out by Mr. M. C. Renshaw, of Chicago, relative to the rise of temperature in the field coils of the motors, and the following observations were made. The car used in the experiments was of the single truck type with seats for 28 passengers. It weighed 12 tons empty, and was fitted with two Westinghouse motors designed to give a mean speed of 26 miles per hour on the level. The actual average speed, including stops, was 10.7 miles per hour. The average number of stops made was between four and five per mile, the average duration of which was four seconds, and the maximum fifteen seconds. The passengers carried numbered 956 in a day of 18¼ hours, and the average load was 24 persons. It is utterly futile to expect a steam railroad to compete with such conditions.

In Germany there are 125 towns or districts with a total of 2,400 miles of electric tramways; great progress is being made with the conveyance of goods by the electric trolley system. During a recent visit to Bochum and Essen in Westphalia the author noticed that four-wheeled wagons, with a capacity of five to six tons of goods, were hauled by electric cars in the early hours of the morning through the streets without any difficulty or dislocation to the ordinary traffic.

In Belgium there are at present in operation nearly 1,500 miles of light railroads, and an additional 1,320 miles are to be constructed; although only 45 miles of these railroads are worked electrically, it is proved that the ratio of working expenses to receipts is less than on steam lines, and consideration is at present being given to a comprehensive scheme for further electrification.

Although our own installations of tramways have been laid out primarily for passenger traffic, there is reason to believe that in several large centers advantage will shortly be taken to introduce goods traffic on an extensive scale. When such schemes are considered, it is advisable in the first place to appoint a traffic manager for the purpose of analysing and scheduling the traffic which would be obtained were facilities offered to traders, for it must be borne in mind that our tramway authorities have hitherto seldom looked beyond the passenger traffic for possible sources of revenue. A local instance may be quoted, showing the advantage of electric as compared with horse traction for the conveyance of material. At the west end of Newcastle, within 2½ miles of the railroad, large building estates are laid out, and upon them are being erected a great number of workmen's houses. The value of each of these dwellings, built principally in flats, is about £480, and out of that amount £32 to £34 per house is expended in the cartage of bricks alone, representing 7 per cent. on the cost of the building. The bricks in this case are carried in springless carts hauled by horses, and if conveyed in electrically propelled wagons, partly over the existing tramways, the cost of cartage

might be reduced by 75 per cent.; and further, an undoubted collateral advantage would be the saving in depreciation of roads, for horses' feet and springless carts carrying from 15 to 20 cwts. on narrow wheel tires account for 80 per cent. of road wear.

If our railroads take a common sense and business view of the matter they will accept the inevitable and encourage goods traffic on electric tramways by making connections into their goods yards and warehouses, allowing the tramway wagons to run alongside and unload or take up loads as the case may be. The railroads will eventually reap a considerable gain, for though they will have to relegate a great portion of the short distance goods traffic to the tramways, the tramways in return will act as important feeders for the conveyance of goods from the railroads to the consumer's depot, and will return with loads for the railroads to convey to distances outside the area operated by the tramways; there will even be an immediate saving to the railroads helping to militate against the loss of a certain amount of local traffic, and that is a reduction in their costly cartage departments.

It is hardly probable that there will be any interchange of rolling stock between railroads and tramways owing to the difference in design, wheel base and load gage. No railroad vehicle can run upon ordinary tramway of standard gage through towns, but there is no physical reason which would prevent tramway vehicles from running upon railroads, and this feature is of great importance in enabling them to work over those siding connections to collieries and factories which also serve for the traffic to or from the railroads. An important point for all tramways to aim at is uniformity of the rail gage, so that there can be a free interchange of traffic without transhipment between tramways in adjacent districts. Special rolling stock will be introduced for the conveyance of minerals and goods on tramways, as the conditions of traffic and variations in load are entirely different from those existing in passenger work; it is probable until many bridges in urban districts are either rebuilt or reinforced that the axle load will be limited to about seven tons.

Sufficient has been said upon this subject to prove that the trend of events points to a very important development in economical transportation, and as progress is made in this direction there will be a closer union between the members of the three great branches of our profession—the Civil, Mechanical and Electrical Engineers—and with that union will arise an appreciation and better understanding of each others' efforts.

Alumino-Thermics and Its Uses for Welding and Metallurgical Purposes.

The theory of alumino-thermics and some of the uses of thermit have already been referred to in these columns (Dec. 11, 1903). The process is the invention of Dr. H. Goldschmid, of Germany, and has only recently been introduced in America. The following notes are from an illustrated lecture before the Franklin Institute, Jan. 20, 1904, by Mr. E. Stütz, Vice-President and Treasurer of the Goldschmid Thermit Company, 41 Wall street, New York:

By combining in a suitable manner the two elements of most frequent occurrence on the earth, oxygen—in the form of oxides—and aluminium, a temperature equal to that of the electric arc is created. The simplest way of producing this enormous heat and utilizing its energy is the object of alumino-thermic science. While the reducing properties of aluminium were discovered about 50 years ago, none of the scientists who studied these properties discovered the all-important fact that a mass of this mixture when once ignited continued to burn throughout the whole mass without the addition of heat from external sources. To illustrate this phenomena some "Thermit" was first ignited by placing grayish black powder into a magnesia-lined crucible. When this was about half filled with the powder a small pinch of ignition powder, one-half as much as would go into an egg spoon, was placed on the mass, and the ignition powder was lighted by a storm match. The operator then added a measured quantity of "Thermit," keeping the light in the crucible well covered up. Then a very bright dazzling light was seen, which quickly increased in brilliancy. When incandescence was reached the operator took hold of the crucible with a pair of tongs and poured the contents into another receptacle. Observers, by the aid of dark glasses, could see that the mass running out first, which is corundum slag, gave out a dull white light, while the liquid steel, which filled the bottom of the crucible, was very brightly scintillating. By the reaction, which takes less than a minute, whatever the quantity of "Thermit" used, the oxygen is made to combine with the aluminium at a temperature of about 5,400 deg. F.

The next demonstration showed the effectiveness of the heat. A ½-in. plate was placed at a slight angle over some bricks; over this plate was placed a conical crucible that could be tapped from the bottom. After the reaction had taken place the liquid metal was poured out in a thin stream on the metal plate, and in two or three seconds a smooth round hole had been burned through the plate. The heat is so concentrated that the plate, which is about 8 in. square, could be held in the bare hands.

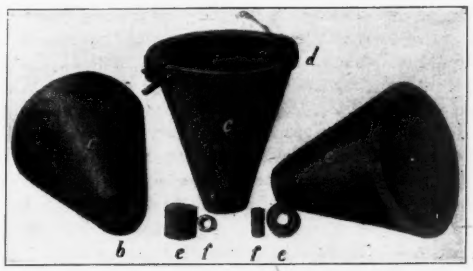
The process has two main divisions so far as its application is concerned. The first concerns the metallurgist, the second the engineer. Its metallurgical uses include the production of pure metals free from carbon, such as chromium and manganese, molybdenum and ferro vanadium. For ferro titanium a very important and special application has been worked out for foundry work. Some of these metals are in extensive use in steel works.

The most extensive use of the welding process is the bonding of the rails of trolley lines. This process has been used in more than 40 towns in Europe. The necessary equipment consists only of a refractory earthenware or sand mould, a magnesia lined crucible, and steel rail clamps. The tendency of late is to dispense with the clamps. The molds and crucibles can be made by the trolley lines in their shops without the use of skilled labor. The weld is made by fitting the mold carefully around the joint and smearing the contact lines with clay so that no liquid iron may escape. The crucible is placed directly over the mold. The "Thermit" is then ignited and when the reaction by which the pure iron is separated out is complete, the crucible is tapped from the bottom. The liquid iron at a temperature much above the melting point of steel dissolves the rail ends and forms a homogeneous mass of mild steel. Sufficient "Thermit" iron is run to form a shoe around the welded joint which has a greater strength than the rail, which fact has been proved by numerous tests. Working without clamps the time per joint is ¾ (three-quarter) hour for one man. Trained squads of four men take less time. At $1.50 per day wages the labor item per joint is 10 cents. The cost of mold and crucible per joint is about 10 cents. Great lengths of third rails have been connected by welding a short iron bridge along the base of the rail at the joint.

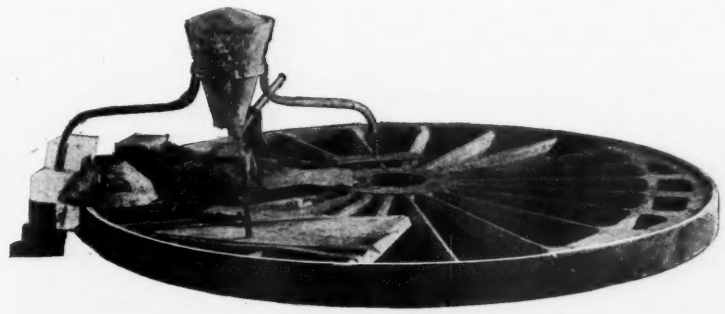
The principles described for welding trolley rails are also applicable to welding any other massive iron or steel pieces. One of the most effective jobs was the welding of the broken stern post of the Hamburg-American liner "Sevilla." About 700 lbs. of "Thermit" were used. The steamer was laid up only a few days, and she has since made several trips between Europe and the Argentine Republic.

In welding wrought-iron pipe the process is reversed. Instead of using the liquid steel to effect the weld, the heat produced in the reaction is all that is required. The slag, which forms a distinct layer over the liquid steel, has the property of adhering to any metal with which it comes in contact, and it is also impervious to the liquid steel. In the demonstration the pipes were placed on a stand and adjusted in a small clamping apparatus. A piece of thin sheet iron was then bent around the joint. Around this was placed a box filled with sand. The "Thermit" reaction was then made in a crucible with a flat bottom. As soon as it was complete the crucible was lifted with the tongs and the contents rapidly poured into the opening of the mold. After a moment the clamps were screwed up, after which the clamps, sand boxes and molds were all removed, and the slag, containing the "Thermit" steel, like the yolk in an egg, came off in the form of a sleeve, on being hit with the hammer a few times. The joint was then brightly glowing and the two ends of pipes were completely united.

Another application of "Thermit" is that by which titan, a most valuable purifying addition to iron and steel, is introduced into these metals while still in the liquid state. The titan is introduced as titan "Thermit" into the ladle by holding it in a box at the end of a pole below the surface of the bath. This gives greater purity to the iron or steel and prevents the formation of gases. It also gives greater fluidity and absence of pores. Special "Thermits" are also introduced into heavy steel ingots to prevent the waste from piping. Where long molds are used the addition of "Thermit" just inside the risers revives steel which is on the point of getting plastic.

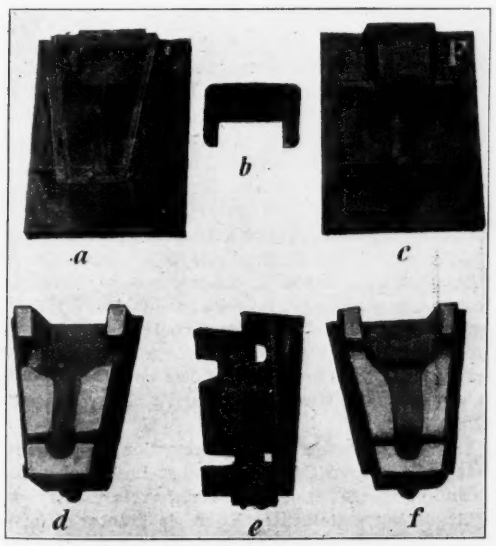


Conical Crucibles Lined With Magnesia.

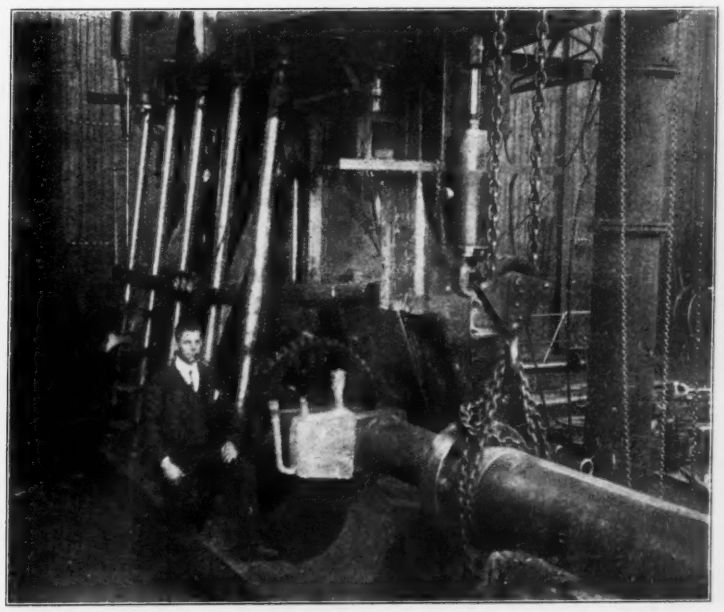


Repairing Locomotive Driving Wheel With Thermit.

Section of Driving Wheel Showing Welds on Spokes.



Details of Mold Used in Welding Third Rail.



Welding Crank-Arm of 1,500 Horse-Power Vertical Engine With Thermit.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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The address of President Eliot, of Harvard University, to the Boston Central Labor Union is in large part reprinted in another column. Those railroad officers who are trying to work systematically for a relief from labor tyranny, who are looking somewhat beyond present contests, will get help from this scholarly review of the past, the present and the principles which govern the relations between employers and employees. The speaker was the guest of a powerful organization of trade unions, and he aimed to tell truths within their comprehension, which may be in the future of some benefit to them. Nevertheless the greater value will be to those thinking men who are mostly included among the employers. He comes to the old, old conclusion that ideal, or peaceable, relations can come only from education. The present educational forces are little other than the results of bitter experience, but that dear teacher has had a large school and a quite regular attendance for several years without clear evidences of improvement in her students.

An unusual amount of space is given in the present issue to Mr. Sheffield's presidential address before the Newcastle-on-Tyne Association of students of the Institution of Civil Engineers. Mr. Sheffield treats of two of the problems which have been troubling English railroad managers greatly during the last two or three years, and his conclusion seems to sum up the situation accurately and concisely. The controversy in the British technical press, extending freely to the "agony column" of the London Times, in regard to the employment of American methods on British railroads, will be recollected. A movement was made to adopt American standards in regard to heavy equipment and also in regard to full working statistics in a way not previously attempted in the United Kingdom. Great antagonism was aroused and there were two distinct parties; one advocating an Americanization altogether too complete, in the view of existing conditions, and the other broadly condemning all American practice. It is doubtless true that both sides overstepped; that while on the one hand traffic conditions, the long-established clearance widths, size of bridges and culverts, etc., on the British railroads render the use of large cars and engines inadvisable, on the other hand there are many features of American management which can be copied with advantage and which are being copied at the present time, although in a quieter and less sweeping manner than was advocated when the controversy was at its height. In his discussion of what might be called the legal ethics of municipal corporations in building tramways to compete with steam railroads and then taxing the steam railroads for their support, Mr. Sheffield touches upon a question which was prominent at the time of the recent agitation for a barge canal from the great lakes to the Hudson, and he suggests as feasible a solution which, unfortunately, cannot be so readily adopted in New York State; that the steam railroads should be exempt from that portion of taxation which goes to the support of its municipal competitors. It will be interesting to observe the way in which this subsequently works out. It is rather surprising, in view of the traditional conservatism of British methods, that the recent experiments in electrification of portions of steam lines should have been so rapid and so extensive. It is obvious that there are important lessons for managers of American lines, or portions of lines, depending chiefly on short haul traffic, in the attempts now being made in England to handle this traffic by electricity on the right of way of the steam railroad. Mr. Sheffield's paper shows how closely the subject has been studied in Great Britain within the last year or so.

What is the best color or combination for the night indication in a distant signal when it is "on"? Assuming that red for on, and green for off, are the most desirable night colors for home signals, something else is needed for a distant signal when it is on. In this country we have for this indication, beginning with the oldest, (1) the combination of a red and a green side by side; (2) the nels yellow, quite dark; and (3) a lighter yellow; and finally, we believe, on one road, a common white light. Uniformity is desirable, but while we are waiting for this the signal engineers of England are taking action looking toward further diversity. From a recent London paper it appears that a committee of the Railway Companies' Association has been considering the inconsistency of English night distant signals, which are exactly like the home signals, and has agreed that the best way to distinguish a distant from a home is to use the Coligny-Welch lamp, which, by reflection, provides a > shaped white light by the side of the colored light. The successful use of the first and second above named in this country appears to have had no effect on the minds of our English friends. Indeed, they seem to be measurably well satisfied with their present practice; for we have not observed any complaint concerning it. This action in favor of the Coligny-Welch light is only an expression of opinion, and appears to be the result, not of any fault in service but of the theoretical inconsistency of having the home and distant alike. As this inconsistency is of a dozen years' standing, possibly the present discussion will not get beyond the academic stage. Perhaps the inconsistency is no greater than that of the American engineman who thinks that his "yellow" lights are about the same color as red but calls them yellow because he is told to do so; or because in daylight the glass is yellow. As a single light is cheaper than a double one, either with two flames or only one flame and a reflector, the yellow light should be good enough if it can convincingly prove its distinctiveness as a color. It has the advantage of simplicity as well as cheapness. We are inconsistent if we call it distinct from red when some runners and signal engineers' eyes can't make the distinction, for there should be no dispute about the identity of a signal color at any time. We have continued to use it on the ground that our practice is no less safe than that of the English, who are guilty of another inconsistency, that of making the home and the distant light just alike. In England everybody knows that the distant is like the home, and no harm ensues; how can the result be any worse with us, where the alleged likeness of the two is not proved? Possibly the distant signal light question remains unsettled because that of the home signal is not fully settled. That so many roads continue to use the white light for all-clear seems to be owing in part to the feeling that a signal should be visible a long distance; and everybody knows that an uncolored light can be seen much farther than a green one. It may be that the best way to hasten the general abolition of white lights in signals will be to improve the green light.

The Rational Basis for Accident Statistics.

On the railroads of Great Britain and Ireland the train mileage and the number of employees is, roughly, half of the total on the railroads of the United States; nevertheless, they carry twice as many passengers, and have only one-sixth as much loss and damage costs. This is the "face of the returns," and has its lesson, although to make the picture accurate we need to go behind these returns and compare the passenger miles in each country; but this information is lacking.

A pamphlet recently issued by Mr. Slason Thompson on the railroad accident statistics of this country and Europe reaches conclusions which seem to be at variance with these figures; and it has the appearance of such care and thoroughness that its fallacies have by so much an undue influence in leading us to error. The prevention of collisions and derailments and the preservation of lives and property are too serious matters to be made the subject of partisan "claims"; the only aim should be to show the simple truth. Mr. Thompson is connected with the General Managers' Association of Chicago and a quasi railroad officer, so that his argument will be taken by many to be the argument of an advocate of the American railroads, and particularly of those terminating in Chicago; whereas, in fact, the comparisons which he offers will do the railroads harm, instead of benefit, by setting up a false standard.

The subject of the first part of the pamphlet is the railroad-accident record of 11 railroads terminating in Chicago, for the year ending June 30, 1903, which is compared with the accident record of all the railroads of Great Britain and Ireland for the calendar year 1901. The mileage of these Chicago railroads, 23,427, is about the same as that of the British railroads (22,078), and the comparison is, therefore, put forward as a fair one, because the average per mile of road, for a given number of casualties, would work out about the same in both cases. But this average is entirely worthless, for the reason that density of traffic—not miles of road—must be the main factor in the computation of any average that is to be a true index of the danger or safety of railroad travel.

Mr. Thompson's principal comparisons are as follows:

	All British R'ds, 1901.	11 Amer'n R'ds, 1903.
Mileage	22,078	23,427
Passengers killed, train accidents	0	0
Passengers killed, other accidents	135	15
Passengers injured, train accidents	476	492
Passengers injured, other accidents	1,669	315
Employees killed, all causes	511	311
Employees injured, all causes	4,243	3,195

"Other persons" are also compared, and a comparison similar to the foregoing is made between 19 American railroads and the whole of the railroads in the German Empire, the mileage of road being approximately the same in each case. Again, 17 American roads, with 55,617 miles, are compared with Germany and Great Britain together, in which countries the aggregate mileage was 56,245. Still further comparisons are given, but all are practically without value by reason of the faulty basis on which they are made.

As Mr. Thompson does not give the names of the roads to which he refers, it is not convenient to correct his comparisons; but as he intends his argument to be illustrative of conditions throughout the country, it will be fair to set forth a few comparisons of roads on which the volume of traffic is known. Comparing the whole United States with the whole of Great Britain and Ireland for a year, we find:

	United States.	United Kingdom.
Length of railroad, miles	208,984	22,078
Train miles, millions	936	400
Passengers carried, millions	650	1,188
Men employed	1,189,315	575,834
Loss and damage, millions dollars	24¾	3⅞

The number of passengers carried on the English roads does not include the season ticket passengers, who, if counted, as they are counted in the American statistics, would increase the total to perhaps 1,500 millions. We give the loss and damage on the English roads as shown in the official report, which is $400,000 less than it is stated by Mr. Thompson. Besides making a mistake in the amount, he also omits to say that it includes personal injuries to passengers. Thus—to restate our first paragraph with more precision—while the English train mileage is 43 per cent. of ours, and the number of passengers carried more than 200 per cent. of ours; and while the number of employees is equal to about one-half ours, the cost of the loss and damage items which Mr. Thompson cites is only 17 per cent. of the cost of the same items in America. There does not appear to be any evidence that the eleven Chicago roads are peculiar among American roads, either for safety or in any other aspect, though they have, doubtless, a larger proportion of "thin" lines than would be the case with roads further east. Probably eleven roads could be picked out in other parts of the country on which no passengers were killed during the year ending June 30, 1903.

Mr. Thompson meets the assertion of the Interstate Commerce Commission that the block system should be more extensively used in this country, with this daring statement: "There is greater safety in discipline without block signals than in block signals without discipline." A man needs to be bold indeed to contradict this kindergarten truth. It is, of course, true that numerous collisions have occurred in this country in spite of the use of the block system; Mr. Thompson might have gone further, and have said that collisions also occur in England, in spite of block signal arrangements which in some respects are bet-

ter than most of those on the railroads in this country. But it should be noted that of the cases which he cites from Government Bulletins 6, 7 and 8, a number appear to have occurred on lines where the block system is not in use. The errors which caused these collisions were in some cases of a kind which might have occurred on a line using the block system; but that possibility does not warrant the inclusion of such cases in a list of accidents purporting to have occurred in spite of block signals. For example, one butting collision was caused by the failure of an operator to deliver a meeting order; but one of the first benefits to be had from the introduction of the block system is the abolition of the methods which make safety dependent on telegraphic meeting orders. One rear collision is put down as due to the failure of the engineman to observe signals and to control speed; this may or may not have been on a block-signaled line. Another butting collision was due to the failure of a station agent to deliver a telegraphic order; but this kind of accident is never reported from a block-signaled railroad.

One of the causes assigned by Mr. Thompson for our collisions is "the restiveness of our trainmen under restraint," a fault which "they share with the entire American people." This view appears to meet the approval of at least one newspaper writer, who, commenting on Mr. Thompson's paper, agrees that passenger fatalities in America are to be charged largely to the universal American propensity to rush things; "we are always in a hurry to get somewhere," and we are so absorbed in our hurrying that we cannot take time to observe the necessary rules of safety. This might be an attractive theory, but for the fact that the railroads of England run many more fast trains than do those of this country.

An Efficient Railroad Employment Bureau.

The Employment Bureau of the Chicago & Alton, which was established more than a year ago and which was noticed in the *Railroad Gazette* at that time (pages 642, 647, in 1902), appears successful. The officer in charge of it, Mr. W. A. Freese, Superintendent of Telegraph, keeps in touch with young men all over the company's lines and reports a considerable number of interviews and examinations nearly every week. It will be remembered that the Bureau is for the purpose of filling vacancies with men whose homes are adjacent to the line of the road. Mr. Freese makes it his business to have an interview with any person desiring to become an applicant or any parent or guardian desiring to have a son or ward enter the railroad service. During a year the company has received 758 applications through the Bureau and has accepted 225, as follows:

	Received.	Accepted.
Brakemen	140	20
Firemen	103	28
Telegraph operators	402	133
Clerks	52	10
Telegraph students	41	28
Linemen	1	1
Train despatchers	7	2
Baggage masters	2	..
Switchmen	3	3
Station agents	7	..

For the position of telegraph operator 32 were rejected on the telegraph examinations, 12 on account of defective vision, 6 on account of physical examination, and 1 on account of failure in the rules. The reason so few of the brakemen and firemen were accepted is that many men were over the age limit, or under the age limit, or deficient physically.

The circular which was issued when the Bureau was established defines Mr. Freese's duties:

> Inasmuch as there are many bright young men who would like to become employes, he will get their record, habits, character, etc., in view of fitness to enter any department of this company, should they so desire.
>
> It is the wish of the management, as far as possible, to recruit its employes from among the people living along its line, so that the interests of the community served by this company may be identical with those of the road.
>
> Mr. Freese will receive applications from desirable young men for positions as students in telegraph offices, clerks in any departments, operators, brakemen, firemen, etc.

Station agents and other employees of the company were directed to co-operate with Mr. Freese "to the end that the road might attain a high order of efficiency;" and a record is kept so that heads of departments wanting help can quickly find what is available and be advised where to look.

The report made weekly to the General Manager gives the names of the applicants whom he has seen during the week, and the names are divided into six classes according to the work that the applicant desires to engage in: Brakeman, fireman, telegraph operator, agent, clerk, student. This weekly report also gives the number of requests in each class received from each division superintendent, and the number of men furnished to each. Also a statement of the number of applicants who have been examined and who have not stood the tests.

Printed forms are provided for securing consents and releases from parents and guardians in the cases of minors, and for a record of service from any railroad company which the applicant may have worked for before coming to the Alton. In the last-mentioned document the applicant releases his former employer from liability for giving information.

The questions which have to be answered on the sheet filled out by the applicant himself embrace not only those dealing with his qualifications for the particular work which he aspires to, but also a number of a searching character, such as, "State your present salary?" "Have you ever been addicted to the liquor habit?" "Is there anything in your past record that, if known, would probably cause a rejection of your application for bond?" The Superintendent must, of course, depend on corroborative evidence for some of the facts which he desires to establish, but the applicant has full opportunity to be as frank as frank can be.

English Refinements in Block Signal Practice.

A late British Board of Trade report describes a double collision in a tunnel at Sowerby Bridge, on the Lancashire & Yorkshire. The signalman let a switching engine be run from the goods yard on the south side to the up line to be admitted to the roundhouse on the north side. This operation could not be finished at once, as a freight train was approaching on the down line. Another down train followed and in the meantime an up express was offered which the signalman accepted, forgetful of the switching engine. All signals were lowered and a serious collision occurred. Some cars of the express were derailed and fouled the down line in an adjacent tunnel. A down passenger train ran into the derailed cars and a passenger was killed.

The signalman is, of course, blamed for the mishap, but the Board of Trade Inspector quotes two rules which are in the railroad company's book of rules, which admittedly are not observed, yet apparently he has accepted the situation and has passed no stricture on the company. A correspondent, quoting these rules, remarks that the observance of either would have prevented the collision. The rules are:

"When a train or vehicles have passed a home signal and are waiting to be crossed to another line or to be let into a siding, or have been shunted on to the opposite running line, or placed on either a main or branch line at a junction, or when a train or vehicles have been shunted from a siding on to a running line and are waiting to be crossed to another line, the guard, shunter, or fireman must, when the train or vehicles come to a stand, proceed immediately to the signal box and remind the signalman of the position of the train or vehicles, and remain in the box until the signalman can give permission for them to proceed, or to be shunted clear of the running lines. The duty of going to the signalman must be performed, in the case of a light engine, or of a passenger train with only one guard, by the fireman, the guard in the latter case remaining in charge of the train. . . .

"Blocking back (inside home signal): When it is necessary after the passing of one train and before giving permission for another to leave the signal box in rear, to obstruct the line inside the home signal, by crossing a train, etc., or by standing a train or part of a train on it, for shunting purposes, etc., the blocking back signal must . . . be given to the signal box or boxes in the rear, and on this being acknowledged by repetition, the block indicator for the line or lines intended to be occupied must be placed or maintained at the Train-on-line position."

The American critic would say, first, that these rules could not be invariably enforced without a good deal of watching, for they are of the kind that men will often shirk. Apparently both the men and the officers shirked in this case, for the officers seem to have admitted non-enforcement. One reason why the first rule is difficult to enforce is that it is too long and wordy, and not easy to grasp. The second rule is not used in America, so far as we know. There are no sufficient records to enable any one to determine the comparative safety of the two practices. An American would say that it is better not to try to "block back" than to try and fail. If no attempt is made to relieve the approaching engineman from strict observance of the home signal, he will be more vigilant to obey its indication. In this case if the engineman had approached under control, according to the blocking-back rule, he, nevertheless, in consequence of the signalman's error, would have found the signal all-clear, and therefore would have concluded that the necessity for slow running had ceased before his arrival. One reason why we have few records of collisions of this kind in America is that many of our busiest lines are equipped with track circuits. The track circuit checks such an error by a signalman.

The Interstate Commerce Commission has given a decision in favor of pooling. This fact is not startling, because it is not of great importance; but it is sufficiently out of the ordinary to be noticed. It is not a positive declaration, it is a negative one, a decision not to convict, in a case which is held to be doubtful; and it has to do, not with freight or receipts, but with passengers; and the pooling of passengers, as we read the law, has never been forbidden. The decision, written by Commissioner Clements, is in the matter of the transportation of immigrants from New York and other Atlantic ports to western cities. This immigrant traffic is divided between the carriers in agreed proportions based upon the proportion of the domestic passenger traffic done by each line. It appears that such a practice cannot be made effective in respect to any other class of passenger business; that the immigrants are carried from the seaboard at domestic published rates; and that the arrangements adopted by the carriers in connection with the immigration authorities of the United States for handling immigrant business have efficiently promoted the protection and greatly improved the treatment and comfort of immigrants. The decision of the Commission is that "whether section 3 of the Act to regulate commerce, prohibiting carriers from entering into any contract, agreement or combination 'for the pooling of freights by different and competing railroads or to divide between them the aggregate or net proceeds of the earnings of such railroads or any portion thereof,' applies to such a division of passengers as has been shown to exist in this case is, at least, doubtful; that no discrimination as against individuals, classes or localities results from the handling by the carriers of this immigrant business at domestic published rates, and that there is no justification at this time for the issuance of any order in the premises."

NEW PUBLICATIONS.

Electric Club Journal. Published monthly by the Club. Price, $1 a year; 15 cents a copy.

The first issue of this publication is dated February, 1904. Its purpose, as set forth in an editorial, is to put into permanent form the best work of the Electric Club and to enlarge the club's scope and usefulness. The Electric Club of Pittsburg was organized two years ago by the engineering staff and apprentices of the allied Westinghouse interests in Pittsburg. It grew out of the semi-weekly course of lectures given during the winter by the members of the engineering staff of the works, to the 200 or more apprentices who were working and studying there. The social side was not lost sight of in defining the purposes of the club and when a club house was secured, provision was made to promote the social as well as the purely technical side of the club meetings. There are now enrolled more than 500 members, employees of the Westinghouse Works, who meet twice a week for lectures and at other times for entertainments and excursions to places of interest to engineers in the vicinity of Pittsburg. The local branch of the A. I. E. E. meets once a month in the club house for its regular sessions. The first issue of the Journal contains a number of interesting articles on electrical subjects and holds out a promise for a valuable technical publication in the future.

TRADE CATALOGUES.

Broderick & Bascom Rope Company, St. Louis, Mo., issues a pamphlet on Aerial Tramways and other applications of wire rope. Some interesting historical facts are given. A copy of a wood-cut from an old German chronicle shows a rope tramway used in 1644, and a half-tone engraving shows a coil of wire rope unearthed at Pompeii. In the engraving it looks little different from the modern product. Different systems of tramways are described, from simple carrier lines to complicated double-rope systems, and illustrations make the text clear. A few words as to cost are given. The other applications of wire rope described include hoist conveyors, underground haulage, log haulage and suspension bridges. The pamphlet is 7 in. x 9½ in., and contains 48 pages.

McComber & Whyte Rope Company, Chicago, issues a "Simple Digest" which explains why they are in business, what kind of rope they make and the service it will give. A folder, "Emphatic Evidence," accompanying the pamphlet, shows an engraving from a photograph of the company's plant, to disprove statements that it has no factory.

Kelley, Maus & Company, Chicago, issue photographic views and brief descriptive matter of their new quarters at the Lake street bridge, over Chicago River. This firm began 25 years ago to supply the needs of wagon and carriage builders, blacksmiths and farriers. The new quarters have 175,000 sq. ft. of floor space and a dock 400 ft. long.

The American Well Works', Aurora, Ill., general catalogue is a 160-page book with alphabetical index of its contents. It illustrates and describes the large line of well-sinking, prospecting, pumping and irrigating machinery, air compressors, air-water lifts, gasoline and steam engines, boilers, etc., which this company makes.

Willis Shaw, Chicago, issues a circular listing some special bargains in machinery, locomotives, gondola and flat cars, hoisting engines, dump cars, graders, steam shovels and dredges, pumps, concrete mixers, cranes, air compressors, engines, and a variety of other machinery.

J. A. Fay & Egan Company, Cincinnati, Ohio, distributes a list of second-hand machines which it has on hand, taken in exchange for new tools. In order to prevent the accumulation of these machines, they are offered at reduced prices.

English Train Accidents.

A collision on the Lancashire & Yorkshire is reported in the editorial column. A second English collision recently reported occurred in a fog on the North Staffordshire Railway. A freight train was run into by a passenger train. The passenger should have been kept back at the tower in the rear, where there is a starting signal and an advance starting signal. It is a disputed point between the towerman and the runner as to whether the starting signal was "off," but the runner admitted that he failed to see the advance signal. He should therefore have treated

the signal as though it was at danger and gone forward with caution. The towerman is also blamed, first for allowing the freight train to leave when the passenger train was due, and second for not stopping the passenger train at the tower and warning the runner that he was to proceed only as far as the starting signal, there being the greater need for this as no fogman was provided at the starting signal.

A third case, on the North British Railway, brings out a decided lack of discipline. The towerman allowed four other employees and a non-employee to be in his tower and play games and smoke. While this was going on a special freight train was offered him which he accepted and it came on. Before it arrived the man in the rear tower had a passenger train to follow so he sent the shunt block bell signal (one, pause, five, pause, five) for the freight to be shunted. In the confusion arising from the men playing, this signal was taken for the cancel block signal (three, pause, five) and therefore when the passenger train was offered it was accepted and a collision ensued. The Inspector's comments on this signalman's conduct are, of course, severe.

Safety Lever for Counterweights.

Mr. J. P. Annett, Signal Superintendent of the London & South Western, has devised the arrangement shown in the drawing to guard against the dropping off of a counterweight in case the bolt by which it is fastened to the balance lever should become loose. In the upper side of the lever he cuts a number of semi-circular notches, and the loose block inside the weight has a projection which will engage with one of the notches when the fastening screw is tightened.

Metal Shield for Two-Colored Light.

Mr. Annett has introduced another interesting device in the shape of a metal shield, shown at *a* in the drawing, to guard against the danger which may arise if an engineman sees rays of light reflected through the green glass when the signal is not in the clear position. In England some signal posts are very high, and enginemen who are stopped close to the post sometimes have to look in a nearly vertical line in order to see the light, and cases have occurred in foggy weather in which the engineman would see the reflection of the green and not see the red. If the signal is fitted with the shield, as shown, it is impossible to see the green light when the arm is horizontal. For this and the preceding note we are indebted to the *Railway Engineer*.

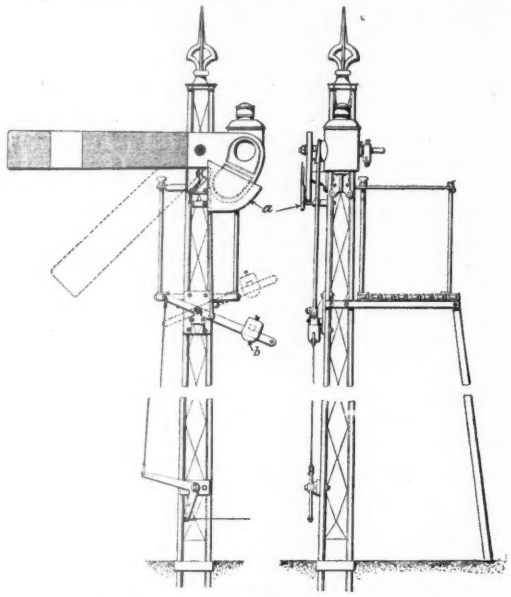
The Cotton Boll Weevil.

W. D. Hunter, Special Agent in charge of cotton boll weevil investigations in the United States Department of Agriculture, has issued a report in which he says that the work of the Division of Entomology for several years has demonstrated that there is not even a remote probability that the boll weevil will ever be exterminated, but although the very large yields of cotton of former times may no longer be possible, it is nevertheless entirely feasible to produce cotton at a margin of profit that will compare favorably with that involved in the production of most of the staple crops of the United States, by following what have become known generally as the cultural methods. Of the greatest advantage is the reducing the numbers of the weevil by destruction of the plants in the fall, and the start thus gained is followed up by bending every effort toward procuring an early crop the following season.

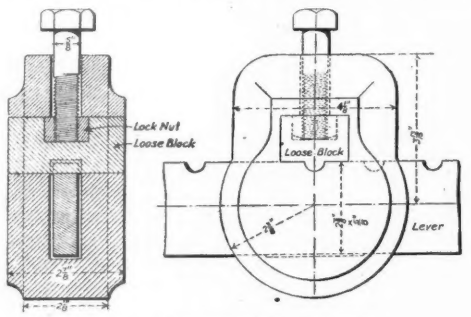
The report further says that it is not probable that there will ever be a more generally unfavorable year for cotton culture in the United States than that of 1903. Towards the close of 1902 a condition of the crop little short of disastrous was reported, following insect ravages and unfavorable climatic conditions in Texas. But 1903 has had as many unfavorable features, and also the drawback that planting was unavoidably thrown from four to six weeks late, which was especially unfortunate for the reason stated above, that early planting is the most important step in avoiding damage by the weevil. Many planters were unable to put in half of their normal cotton acreage, and the late planting season was followed by severe droughts alternating with heavy rains. In 1902, on a certain cut of 180 acres in Robertson county, Central Texas, 65 bales of cotton were produced, while on the same land in 1903 only 15 bales were produced, and this instance is typical of a great many plantations in that part of the State. Up to the present time, the boll weevil has only been found outside the state of Texas in three isolated instances in the United States. The northern limit of the pest just touches the Red River, the eastern limit goes to the western border of Louisiana, and the western limit is at present in Brown county in Central Texas. The region in which the weevils have multiplied to such an extent as to be found in all cotton fields, however, falls considerably south of the northern boundary of the territory where isolated colonies are known to exist. A comparative estimate of the amount of damage done by the weevil shows that in ten typical counties 371,349 bales were produced in 1899, when the insect was not present, while the same counties only produced 174,174 bales in 1902, a decrease of 53 per cent. Ten counties in which the weevil was not present in either 1899 or 1902, however, show an increase in production of 11 per cent. during the period, so the approximate damage caused by the insect as represented by the sum of the decrease in one case and the increase in the other would seem to be 64 per cent. Care has been taken in selecting characteristic regions, where the comparison would not be affected by foreign circumstances such as a change in acreage, and the normal difference in the seasons quoted was not noteworthy.

The Division of Entomology of the Agricultural Department is carrying on experimental studies in fields aggregating 550 acres, in addition to laboratory work. The experimental fields are located at seven points representing the five regions in Texas which, by reason of variations in climate and soil, constitute as many distinct cotton districts. Under a contract, representative planters at each place have undertaken to prepare the land, plant and care for the crop in every detail exactly in accordance with the directions of the Division of Entomology. This system gives the Division practically complete charge of large tracts of cotton, without involving the expense of renting the land and working the crop, and has been found to be a most satisfactory method of conducting such field work on a large scale. Every useful expedient in avoiding damage by the weevil has been tried, including early varieties, different methods of planting, special cultivation, rotation, fall destruction of the plants, etc. Wherever a field was treated in any unusual manner, another one alongside of it was given only the ordinary attention as a check. The recommendations following the experiments are summed up under the heads of thorough cultivation of the fields, planting the rows as far apart as feasible and destroying all stalks in the fall.

The steady extension of the territory affected from year to year, until the northern boundary is now far north of the center of cotton production in the United States, makes it seem probable that it will eventually be distributed all over the cotton belt. In ten years it has gradually advanced a distance of about 500 miles, and will undoubtedly invade new territory at about the same rate. It is not at all likely that legal restrictions of any kind can prevent or materially hinder its spread, and the slowness of the progress up to the present time indicates that the principal means of spreading are natural ones, like the winds and simple overflow from field to field; while artificial agencies, like transportation in seed or in other commodities, are comparatively unimportant. Otherwise, with the extensive shipping from Texas, the pest, instead of being confined to that State, would now be found in many localities throughout the South. Legal restrictions could only be directed towards these artificial means of distribution, and would be expensive and difficult to enforce, yielding benefits which could be no more than temporary, while they might be more than balanced by the damage resulting from interference with shipping.



London & South-Western Semaphore.



Annett's Counterweight Fastening.

A Solid Floor for Deck Girders.

High-speed trains are found to be the greatest source of danger to wooden-floor bridges, as usually little attention is given to locality in dumping ash-pans while running fast, and bridges often receive a part of the contents. Another agent destructive to these floors is derailed trains, but fire has been the really serious matter, and it has been bothering the Chicago, Burlington & Quincy considerably. The design of solid floor for deck girders presented herewith is their solution of the problem.

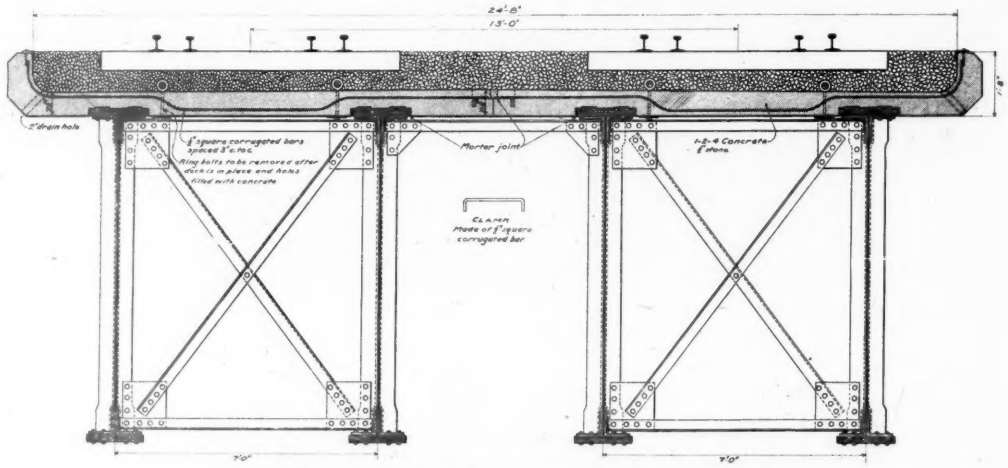
The floor is formed of re-inforced concrete slabs 4 ft. wide, which is the dimension parallel to the track; being for a double track, the sections are in halves transversely. They are made of 1-2-4 concrete, with ½-in. stone. Reinforcement is furnished by ½-in. square St. Louis Expanded Metal Fireproofing Co.'s corrugated bars, spaced 3 in. centers, there being 15 bars to each slab. The form to which these bars are bent is shown in the drawing.

These slabs can be built at any convenient point away from the bridge, and transported and lowered into place when ready. For ease of handling, ring bolts are inserted in the slabs, secured on the under side with nuts and large washers. When the section has been set in place these bolts are withdrawn and the holes filled with cement.

The under side of the slab is formed to fit over the girder flanges as shown, and a joint formed between slab and girder with mortar. The abutting ends of the halves have recesses formed in them for the insertion of clamps made of corrugated bars to the form shown in the detail. These clamps are spaced the same as the re-inforcing bars. The abutting ends are also shelved out at the top to form, when meeting, a rectangular trough which is filled with mortar. The slabs are also tied together longitudinally with three of the ½-in. square clamps.

The thickness of the slabs at the inner ends is 8½ in. and at the outer ends 7½ in., giving a side-drainage drop of 1 in. A drain hole, 2 in. in diameter, is formed at the base of the fillet of the upturned outer end. Its position is shown in dotted lines in the drawing. Before putting in the ballast, the surface of the deck is coated with ½ in. of California asphalt. The inner corners of the upturned outer ends are protected by guard angles, 4 in. x 3 in. x ⅜ in. These angles are put on after the slabs are in place, holes being drilled for the lag screws, which are set in cement.

The weight of the deck and track complete is 2,640 lbs. per ft. of single track. This includes everything above the girder. The same design of girder is used with these floors as with wooden floors, giving an increased dead load and higher unit stresses. However, in consideration of the reduction in vibration which the mass of concrete and ballast must effect, it is believed that this increase in unit stresses is justifiable.


24'-0"
13'-0"
2" drain hole
4" square corrugated bars spaced 3" c. to c.
Ring bolts to be removed after deck is in place and holes filled with concrete
Mortar joint
1-2-4 Concrete 8" thick
CLAMP Made of 4" square corrugated bar
7'-0"
7'-0"

Solid Floor for Deck Girders, Chicago, Burlington & Quincy.

This design is not the accepted standard of the road. It is regarded as experimental and is now being put on three bridges. It was worked out by Mr. C. H. Cartlidge, Bridge Engineer, through whose courtesy the description is presented.

The first mails over the Siberian Railroad arrived in Shanghai Oct. 23, forwarded by steamer from Dalni. The Berlin mail had been 22 days on the way. By the Suez Canal the time has been 31 to 34 days.

Railroad Franchise Values in Texas.

BY W. H. COVERDALE.*

The years from 1850 to the beginning of the civil war marked the rapid growth of railroads in the middle west, and the consolidation into trunk lines of the various smaller companies throughout the more thickly populated eastern States. In those days the railroad was in name and, in fact, a private corporation operating without restrictions as to rates and methods. To-day the railroad is a public service corporation, and as such is in a measure subject to government restrictions as to rates of traffic, public convenience, and publicity of operation.

In 1868 to 1872, during which years many of the western roads were constructed, the overcapitalization of these new lines was such that, notwithstanding government land grants and money bonuses, disaster was not averted in the panic of '73. The lesson learned then has not been forgotten, and the conservatism of to-day is substantial in character when compared with past conditions.

Disregarding the possibility of government ownership or control of railroads as too radical a departure from present conditions, and considering only government supervision in all matters including traffic rates and capitalization, and proceeding also upon the basis of rates which competitive traffic will bear, the question may now be asked, "Wherein consists the security of a railroad mortgage, and what assets may with propriety be considered as collateral therefor?"

In answering this question, it is necessary to keep in mind the essential difference between a mortgage on real estate or on a manufacturing plant and a mortgage on railroad property. Land has a real value which may readily be ascertained, and its value as a mortgage security is that percentage of its market value which can be obtained for it at a forced sale; a manufacturing concern has also real value in such assets as real estate, plant, stock, and finished product, and such a property should wreck for more than the amount of its outstanding obligations.

A railroad, it is true, has some real assets in the way of land, roadbed, buildings, and rolling stock, but it produces from this property nothing but that intangible, highly perishable commodity called transportation; it must operate even at a loss to prevent utter ruin; it cannot be devoted to other uses; it cannot be sold under foreclosure because its use is so restricted, and purchasers therefore few, that it must generally be reorganized upon a more conservative basis, which means a loss to security holders.

A railroad mortgage is, therefore, secured only in part by its physical assets, notwithstanding the legal phraseology on the bond, and in part by its franchises and special privileges which contribute to its earning power no less than do its rolling stock and track.

Inasmuch as an ex post facto law has never been in general favor, it seems improbable that a readjustment in capitalization of existing roads could be made by government authority except at times of reorganization. At such times with full operating statistics available, a fair valuation could be made in the following manner: Take the average yearly gross earnings and deduct therefrom the average operating expenses plus a proper amount for annual maintenance, taxes and betterments; then set aside such amount as a reserve fund as will in the course of a few years provide a surplus against fluctuation of business, and the balance capitalized will represent the amount of securities which the property is worth. By deducting from this sum the physical cost of value of the property we get the proper value of the franchises, good will, or earning capacity.

For example, let us take a railroad earning a gross income of $10,000,000 per year. Such a road in Texas would be 2,000 miles long, as the average gross earnings of railroads in that State are about $5,000 per mile. Deduct now 70 per cent. for operation, maintenance and taxes, which again fairly represents actual conditions, and we have a balance of $3,000,000. Out of this sum set aside 5 per cent. of the gross earnings, or $500,000 for reserve fund, and we have a balance of $2,500,000. Capitalizing this balance at 5 per cent. we get a total of $50,000,000, which represents the total value of the property. The average cost of construction and equipment per mile as determined by the Texas Commission is about $16,000, so that the physical value of our railroad would be $32,000,000, leaving an actual value of $18,000,000 to be ascribed to franchises and earning power.

This total valuation would be at the rate of $25,000 per mile, as against $46,691 per mile, which was the average in Texas in 1900, just prior to the act under which the Commission was created; and as against $16,120 per mile, which is the average for all the Texas railroads which the Commission has valued. Such a method is conservative when compared with uncontrolled capitalization, and it more nearly approximates actual conditions than the restricted method which considers physical values only.

The above figures represent both bonds and stock, and for two reasons: The first is that the Texas Commission figures include both classes of securities; and the second is that railroad stocks should have an investment rather than a speculative value.

In the case of new roads where no earning statistics are available, these could be estimated on a conservative basis from adjacent roads, or they could be omitted entirely and a temporary or partial valuation made on the cost of construction. Such valuation should be supplemented on the more liberal basis as soon as the earning capacity of the road is demonstrated; and in valuations of both old and new roads provision should be made for increase of capitalization commensurate with growth of earnings and physical improvements.

I have spent considerable time in Texas on railroad work, and am superficially acquainted with the methods of the Commission in the matter of valuations. I had the pleasure of being on a railroad inspection trip in 1902, and was much impressed with the thoroughness and care evinced even to matters of small detail. The Texas Commission has had a wholesome effect on Texas railroading, and is popular with both the railroads and the public.

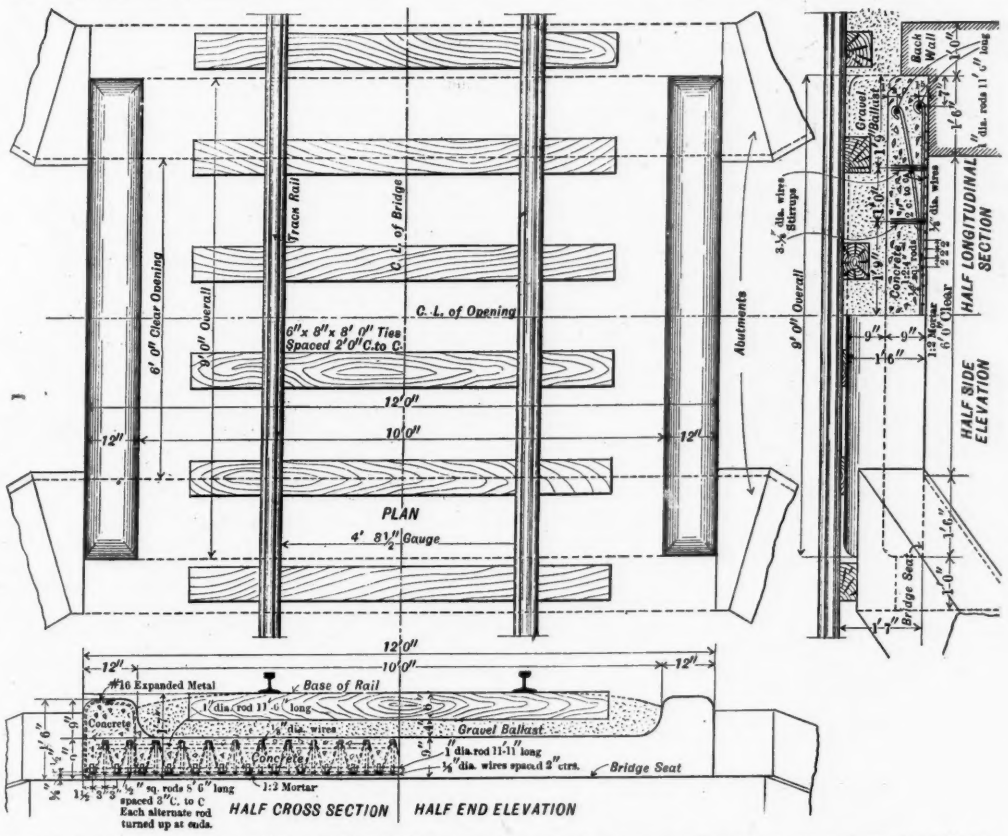
In closing I wish to note three pertinent items:

1st. The Texas railroads constructed prior to the passage of the act of 1893 seem to have an advantage over those built since, as their capitalization is unaffected. Perhaps this is a fallacy, however, as over 90 per cent. of them were in the hands of receivers when the law took effect.

2d. Railroads doing an interstate business are not affected in the matter of capitalization as are those entirely in the State, for the reason that they can still issue blanket mortgages covering the whole property irrespective of the Texas law.

3d. The practice of the Commission in allowing first cost of construction without depreciation seems to favor unduly those roads which are not properly maintained, and there are several of this kind in Texas.

*Consulting engineer, 66 Broadway, New York.



Fixed load, 1,950 lbs. per ft.; moving load, 62,500 lbs. per axle; bending moment, 111,700 ft. lbs.; shear, 125,630 lbs.

Concrete-Steel Girder—American Railway Engineering and Maintenance of Way Association.

The Theory and Design of Reinforced Concrete.*

Rectangular beams have been tested in flexure and a theory has been evolved by M. Considère in France, which has been revised and improved by Professor W. K. Hatt in this country. This theory agrees quite well with experiments made under certain conditions favorable to the theory, whereas under other conditions of loading and design the theory does not apply; in fact, it is a question if the theory of flexure should apply to such cases; or, instead, some new theory which will have to be evolved. In some reinforced beams recently tested, in which the span was short, as compared with the depth of the beams, the metal reinforcement would pull out at the ends, and, at the same time, the beams would fail by shearing without bringing any apparent strain on the metal. In comparing these tests with others made at the same time, in which the span was long, as compared with the depth, in which the metal developed its full tensile strength without slipping, it was suggested that if the metal reinforcement in a beam could in some way be prevented from pulling out at the ends, it would be possible to design a beam of any depth which, upon testing to destruction, would fail by giving way on the tension face. In order to accomplish this, all that was necessary was to anchor the rods at the ends of the beam, when the full tensile strength of the metal could be obtained every time, provided the percentage of metal used did not exceed certain limits. The rods used in all cases were plain rods of medium open-hearth steel, obtained from ordinary stock, and the only requirement was that they should be capable of bending cold around a radius equal to the thickness of the bar.

Two concrete-steel girders have been built on this plan for the tops of culverts, one having an 8-foot span and the other an 18-foot span. In the short span, the ballast under the cross-tie is only four inches deep, so that the effect of impact and vibration from the moving loads should be very marked, and will be watched very carefully. The cut shown herewith is a design for a girder built on this plan. The longitudinal rods have the ends bent around a transverse rod, the latter forming the anchorage. This is done in the field by bending the rods cold around the nose of an ordinary blacksmith's anvil. This does not require skilled labor, and the lengths of the rods, center to center of eyes, need not be made exact, as the mortar fills up all open spaces in the eyes. It should be explained that the transverse anchor rods serve a double purpose. In addition to their value as an anchorage they are intended to serve as a bond between the longitudinal sections of the concrete, when it becomes necessary, for practical reasons, to lay the concrete in sections, as is usually the case, instead of in one piece.

As to the theory of concrete-steel beams reinforced in this manner, we understand that the entire subject of concrete-steel will be taken up by a committee to be appointed by the American Society of Civil Engineers. This matter will come before the Society at the annual meeting on January 20, 1904. This committee will probably have the means to make some tests which will enable them to establish a satisfactory theory, and, as they will co-operate with any other committee working on this subject, we suggest that your committee be instructed to co-operate with them as soon as their committee is appointed.

Pending further experiments the committee recommends that the theory for concrete-steel beams as given by Professor W. K. Hatt† be used.

*Abstract of a report by a committee of the American Railway Engineering and Maintenance of Way Association, Bulletin, No. 47.

†See *Railroad Gazette*, Oct. 10, 1902, p. 772.

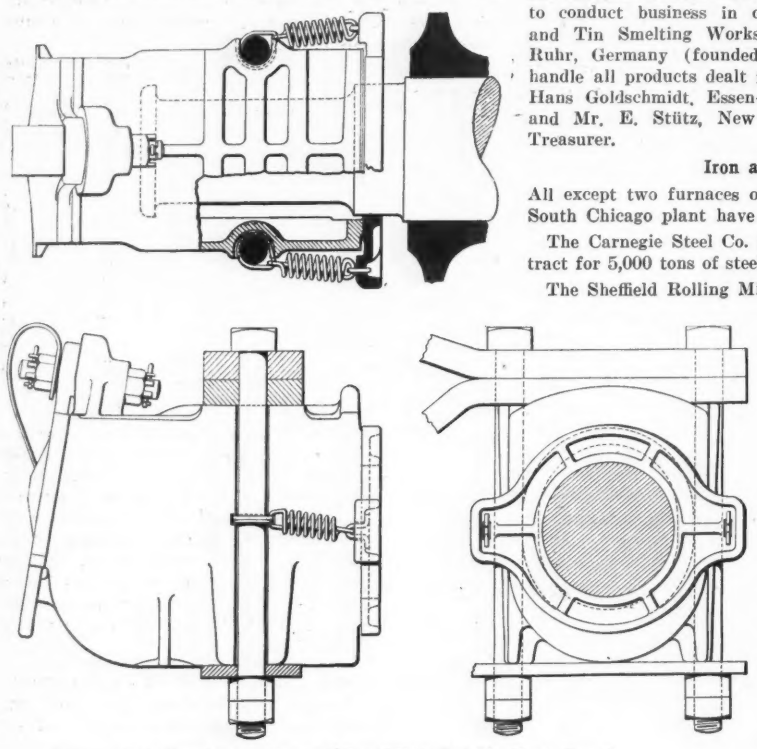
The Symington Journal-Box With Outside Dust Guard.

The accompanying illustration shows the application of a new type of dust guard recently developed by the T. H. Symington Company, Baltimore, Md. It is designed especially for the Symington ribbed box, which was fully described in these columns, May 8, 1903. The entire rear end of the journal box is cut off and the back of the box is machined off to a perfect joint. The dust guard, consisting of only three parts, is composed of a single gray iron casting that is faced off and bored out $^1/_{32}$ in. larger than the dust-guard seat of the axle. This casting is held to the box by means of two helical springs that are fastened to the dust guard and to the journal-box bolts with a ring that is inserted in small annular grooves in the box behind the arch-bar bolts. Only one size spring is used for all sizes of journal boxes, and the company agrees to replace, free of cost, any spring that fails in two or three years' service. There is no possibility for the dust guard or springs to become clogged with dirt so as to lose their efficiency. The springs have an upward inclination which relieves the axle entirely of the weight of the dust guard. The dust guard is free to move up or down or to either side, while the projections on the ears of the guard prevent it from turning with the axle. Eighteen months' experience shows that a large mileage can be obtained with a very slight wear on the dust guard and axle.

The dust guard is put on the axle before the box is put

on. The side springs are then pulled out and the arch-bar bolts are dropped through the clevises on the ends of the springs. When the journal-box is made with solid metal dust guard attached, it is troublesome to get the box on the axle. This dust guard provides from ⅜ in. to ½ in. more clearance between the hub of the wheel and the face of the box than the Master Car Builders' standard design.

It is claimed that the saving in the weight of the box



The Symington Journal Box With Outside Dust Guard.

permits this new design to be sold complete, with dust guard, at the same cost as the regular Symington box fitted with any patented dust guard. The company guarantees the dust guard to last as long as the car wheel.

TECHNICAL.

Manufacturing and Business.

The National Steel & Wire Company has announced the appointment of Ralph C. Caples as traffic manager.

The Northern Engineering Works, of Detroit, Mich., builders of electric and hand-power cranes, have increased their capital stock to $150,000.

The Fay & Bowen Engine Company, of Geneva, N. Y., has been incorporated with a capital of $40,000. W. L. Fay, E. S. Bowen and Henry Brewer, of Geneva, are directors.

The Nickel-Steel Corporation has been incorporated in Delaware. Capital, $200,000. The incorporators are Andrew Marvel, C. A. Darby and S. F. Coursen, of Wilmington, Del.

The Pittsburg Shear, Knife & Machine Company, of Pittsburg, Pa., has recently changed its name to The Heppenstall Forge & Knife Company. The management remains the same.

The Standard Truck & Forging Company, of St. Louis, Mo., has been incorporated with a capital of $600,000, to make railroad trucks. Frank G. Koehler and John O. Marshall are incorporators.

The Brooklyn Foundry Company, of Brooklyn, N. Y., has been incorporated, with a capital of $100,000. H. H. Hall, of Brooklyn; R. B. Banton and B. Moore, of New York City, are directors.

The Continental Metal Company, of New York, has been incorporated, with a capital of $10,000, to make bearing metals and journal boxes. Samuel Metcalf, E. H. Smith and others are incorporators.

The Rand Drill Company reports since the first of the year a large increase in sales of air drills, wood-boring machines and hammers, and the installing of a number of pneumatic tool plants in railroad and other shops.

The Georgia Bridge Company, of Atlanta, Ga., has applied for a charter. The company proposes to make and sell iron and other material used in bridge construction. George H. Crafts, Hamilton Douglas and others are interested.

The Penfield Coupler & Manufacturing Company, of St. Joseph, Mo., has been incorporated with a capital stock of $500,000, to make patent car couplers. The company is making plans to build new shops. A. H. Penfield, St. Louis, Mo., is interested in the company.

The partnership of Gilbert & Peddle, Architects and Engineers, extending over the past year, has been dissolved, by mutual consent. Mr. Bradford L. Gilbert will continue his architectural practice at the present offices in the Tower Building, 50 Broadway, New York, as occupied for the past 17 years.

The Sherwin-Williams Company recently shipped a solid train of 18 cars of paints and varnishes from Cleveland, Ohio, to Texas. The Baltimore & Ohio had the train from Cleveland to Chicago, where the Chicago, Rock Island & Pacific took charge of it as far as Kansas City. At the latter point it was turned over to the Atchison, Topeka & Santa Fe, which took it to destination.

The Goldschmidt Thermit Co., 43-47 Exchange place, New York City, has formed a corporation under the laws of the State of New York, for the purpose of exploiting the Alumino-Thermic Process. The company proposes to conduct business in connection with the Chemical and Tin Smelting Works of Th. Goldschmidt, Essen-Ruhr, Germany (founded 1847), and is prepared to handle all products dealt in by the parent concern. Dr. Hans Goldschmidt, Essen-Ruhr, Germany, is President, and Mr. E. Stütz, New York, is Vice-President and Treasurer.

Iron and Steel.

All except two furnaces of the Illinois Steel Co. at the South Chicago plant have resumed operations.

The Carnegie Steel Co. is said to have received a contract for 5,000 tons of steel rails for Korea at $20 a ton.

The Sheffield Rolling Mill, of Sheffield, Ala., will soon be in operation. This company contemplates extending its works by building a large steel plant.

The United States Steel Corporation has received orders for 15,000 tons of rails from Western roads, including 4,000 tons for the San Pedro, Los Angeles & Salt Lake.

The Sherman Iron Works, of Sherman, Texas, which have been idle for some time, will soon resume work, having passed into the hands of T. H. Eastwood, of McMinnville, Tenn., and others.

The 10-in. mill of the Diamond State Steel Co., of Wilmington, Del., has been put in operation, after being closed several months. An accident to the 18-in. mill has necessitated repairs before it can be put in operation.

The Lackawanna Steel Company is said to have sold 25,000 tons of rails to the New York Central at $28 a ton, to be used by subsidiary companies. This, with the recent sale to the "Soo" lines of 10,000 tons and other sales, makes total orders of more than 40,000 tons in two weeks.

Block Signals on the Missouri Pacific.

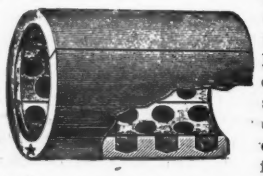
The Missouri Pacific has let to the Union Switch & Signal Company a contract for automatic block signals on 54 miles of its line near St. Louis. It would appear that this is the beginning of extensive plans for block signaling long sections of the company's lines. St. Louis papers say that the officers have in contemplation the signaling of the line from St. Louis westward to Kansas City, 283 miles, and from St. Louis southward to Poplar Bluff, Ark., 166 miles.

Prices for Repairs of Steel Cars.

The committee of the Master Car Builders' Association which is to make a report on this subject at the next convention, has issued a circular letter of inquiry containing 35 questions, from the answers to which the committee hopes to formulate recommendations for an equitable scale of prices. The first 18 questions cover the number and kind of steel and steel underframe cars in service, and the remainder refer to existing practice in repairing such cars. Replies should be addressed to T. H. Russum, Supervisor of Car Department, B. & O. R. R., Baltimore, Md., who is chairman of the committee.

Star Metaline Sheave Bushings.

The S. S. "Dakota," sister ship to the "Minnesota," was launched from the yards of the Eastern Shipbuilding Co., New London, Conn., on Saturday, Feb. 6. These two ships, which are the largest ever built in this country, are 630 ft. long and have a gross tonnage of 21,000. Although they carry no sails, they require four times the number of blocks and sheaves as for a large sailing vessel. Nearly 20 tons of blocks were ordered for each ship. The cargo hoisting sheaves are made of steel and have a capacity of from 40 tons to 60 tons each. Star Metaline bushings were specified for the heavier blocks and roller bushings for the lighter work. The construction and appearance of one of these Star bushings is shown in the accompanying illustration. They are made by the Boston & Lockport Block Co., Boston, Mass.



Meeting of American Institute of Mining Engineers.

On account of the disastrous fire at Baltimore the annual meeting of the American Institute of Mining Engineers, which was to have been held in that city Feb. 16 to 19, will be held instead at Atlantic City, N. J., beginning Tuesday evening, Feb. 16. Headquarters will be at the Brighton Hotel and the meetings will be held in the ball room of the Rudolph Hotel. Members and others who are planning to attend the meeting should address the proprietors of the Brighton at once. There are a number of other first class hotels in Atlantic City to which those applying for accommodations will be referred when the headquarters is filled. Further information may be obtained from R. W. Raymond, Secretary of the Institute, 99 John street, Baltimore, Md.

Subjects for Discussion by the M. M. Association.

The committee on subjects of the Master Mechanics' Association has sent out a circular of inquiry to members asking advice regarding subjects to be submitted to the next convention for discussion during 1904-05. The heads under which these subjects are to be investigated are (1) Committee Work; (2) Individual Papers; (3) Topical Discussions. The first is the best method for investigations requiring tests and experiments, as several should co-operate in such work. The second provides for the presentation of a subject by an individual member who, as a result of having carefully studied some feature of interest to the Association, is enabled to make a contribution of interest and value. Topical Discussions, or Noon-Hour Discussions, as they are called, are an important feature, bringing out much valuable information that otherwise would not be obtained.

Replies should be sent to Mr. Henry Bartlett, Chairman, Superintendent of Motive Power, Boston & Maine R. R., Boston, Mass.

C., M. & St. P. Electric-Lighted Cars.

On the Chicago, Milwaukee & St. Paul the lighting of trains by electricity was begun over 16 years ago. The officers have found that the most reliable and efficient system is that in which a dynamo is run by a small engine in the baggage car and taking steam from the locomotive. Each car of the train has an auxiliary storage battery. Nine electric-lighted trains are in service every night, each train consisting of 10 cars. Chief Electrician C. R. Gilman states that the failures from all causes have averaged about five per cent. of the hours of lighting, and that most of this is due to the failure of locomotives in severe winter weather. Altogether the road has 283 cars equipped for this method of lighting, 146 coaches, 60 sleepers, 23 mail cars, 12 dining, 19 baggage, 18 parlor and 5 buffet cars. In addition there are 8 coaches and 9 sleepers which are lighted entirely by storage batteries. The electrical department is now experimenting with axle lighting, having equipped three cars with as many systems. This makes a total of over 300 cars, which is the largest number of electric-lighted cars in service on any one railroad in the country.

The Andrew Carnegie Research Scholarship.

Andrew Carnegie, President of the Iron and Steel Institute (London), has presented to that organization $64,000 in Pittsburg, Bessemer & Lake Erie 5 per cent. debenture bonds for the purpose of awarding annually a research scholarship or scholarships on recommendation of the council of the Institute. Candidates, who must be under 35 years of age, must apply on a special form before the end of February to the Secretary of the Institute. The value of the scholarship to be awarded each year is left to the discretion of the council, and the award will be made irrespective of sex or nationality. The object of the gift is not to facilitate ordinary collegiate studies, but to enable students who have passed through a college curriculum, or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with a view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school or works, provided it is properly equipped for the prosecution of metallurgical investigation. The appointment shall be for one year, but the council at its discretion may renew the scholarship for a further period, instead of proceeding to a new election. The results of the research shall be communicated to the Iron and Steel Institute in the form of a paper, to be submitted to the annual general meeting, and if the council considers the paper to be of sufficient merit, the Andrew Carnegie gold medal shall be awarded to its author. Bennett H. Brough, Secretary, 28 Victoria street, London, may be addressed.

Bending Stresses in Axles.

Dr. C. B. Dudley, Chemist of the Pennsylvania Railroad, in discussing the effects of alternate bending stresses on steel in a recent issue of the *Iron and Steel Metallurgist*, points out the greater the difference between the maximum fiber stress and the ultimate tensile strength, the longer the life of the steel subjected to such alternate stresses. In other words, contrary to what would naturally be expected, a stiff steel resists alternate bending stresses of a given fiber stress better than a softer, tougher steel. The experience of the Pennsylvania Railroad with car axles is interesting. Steel axles were first used on the Pennsylvania in 1875. The maximum calculated fiber stress between wheels was about 15,000 lbs. per sq. in., and the maximum fiber stress in the journal was about 6,700 lbs. per sq. in. The steel in these axles was an acid, open-hearth steel, containing from 0.22 to 0.28 per cent. carbon, and not over 0.04 per cent. phosphorus, and with a tensile strength of about 65,000 lbs. per sq. in. and an elongation in 2 in. of over 25 per cent. So tough was this steel that one passenger car axle was tested under the drop with 67 blows without rupture. Some 300 of these axles were put in service, and in the course of two years the journals began to fail from detail fracture. The matter became serious, and a consultation was held as to how to meet the difficulty. There seemed but two ways of procedure, either to increase the size, or to change

the nature of the metal. Since any increase in size meant a re-design of all the parts, the latter alternative was chosen, and a metal of 80,000 lbs. tensile strength was substituted for the softer steel, no other changes being made. This completely cured the difficulty, and no case of breaking in detail in car axles is known to have occurred since that time, unless the metal was of lower tensile strength than the figure given, or the axle was worn to limit, so that the maximum fiber stress was too high.

The Pennsylvania Railroad's Exhibits at St. Louis.

In addition to its locomotive-testing plant, the Pennsylvania Railroad will have on exhibit in the Transportation Building a number of interesting models and collections of maps and photographs showing the improvements planned or recently completed at different points on the company's lines. Among the locomotives to be tested is the De Glehn compound Atlantic type engine ordered for the Pennsylvania last year, and which will be thoroughly tested in actual service after the Fair. This locomotive is now on its way over from France and is expected to reach the United States before the end of the month. It will be assembled at Altoona and given a few preliminary runs before being sent to St. Louis. A model of the Pennsylvania, New York & Long Island tunnel under the North River, Manhattan Island, and the East River will be shown. It will be a longitudinal section on a scale of 1:1000 and will show the different constructions to be employed for its entire length of 6 1/5 miles. Detailed models of the special cars and locomotives to be used in the tunnel will be grouped conveniently for reference around the large model. A full-sized section of the tunnel, 20 ft. long, will be exhibited to accurately show the method of construction and the arrangement of tracks and electrical apparatus and wiring. The terminal station in New York will be shown by a model on a scale of ¼ in. to 1 ft., so arranged in sections as to show the interior of the station and the train platforms on the tunnel level. The recent improvements made at West Philadelphia are to be illustrated with a large model on a scale of 1:1000 which will show the arrangement of tracks, crossings, tunnels, elevated structures, etc. The total floor space to be occupied with these exhibits in the Transportation Building is 33,000 sq. ft. In the Government Building will be a postal car built by the Pennsylvania and loaned to the Post Office Department for exhibition purposes. An exhibit of the works and methods of the Relief, Saving Fund and Pension departments of the railroad will be made in the Department of Social Economy (Government Building). It will consist of reports, regulations, graphical charts and other documents showing the growth of these auxiliary organizations and the results accomplished.

Locomotive Tests at St. Louis.

The advisory committee of the Pennsylvania Railroad Company having in hand the locomotive testing at St. Louis, held a meeting in Pittsburg on Thursday, Jan. 28. It is understood that the subjects under discussion concerned the types of locomotives to be chosen for tests, and the character of the observed and calculated data to be secured from each locomotive testing. The following persons were present at the meeting: Messrs. Herr, Sague and Goss, representing the American Society of Mechanical Engineers; Messrs. Clark, Vaughan and Quereau, representing the American Railway Master Mechanics' Association; Mr. Willy, representing the Baldwin Locomotive Works, and Messrs. Casanave, Nelson and Wall, representing the Pennsylvania.

THE SCRAP HEAP.

Notes.

At Egypt, Ga., one night last week, the private car of the President of the Atlantic Coast Line, attached to the rear of a passenger train, was entered by a negro robber who wounded the porter of the car by a pistol shot and then stole the watches, money and clothing of all of its occupants.

At St. Paul last week the Soo line announced a reduction in passenger rates to Eastern cities to the low basis which was in effect last month when the rate between St. Paul and Chicago was down to $8. This reduction was followed by the restoration of the $8 rate by two of the lines from St. Paul to Chicago, which means irregular rates by all lines for another indefinite period.

Rev. B. W. Arnett, a negro, and one of the Bishops of the Methodist Episcopal Church, got around the "Jim Crow car" laws of certain Southern states recently by hiring a whole sleeping car from Cincinnati to Mobile. Eleven other clergymen (colored) accepted the hospitalities of his car, thus, presumably, mitigating the severity of the money penalty which Mr. Arnett had to pay on account of the separate car laws.

The State railroad commissioners of Missouri have disapproved a rule of the Central Car Service Association at St. Louis, recently announced, reducing to 48 hours the free time allowed for unloading soft coal. The reason given for this decision is that the service afforded by the railroads in St. Louis for the coal dealers has not improved since 1895, when the commissioners last discussed the subject of demurrage rates. In fact, say the commissioners, the service has grown worse, and, therefore, the free time hitherto allowed (72 hours) is declared to be reasonable.

The Naval Appropriation Bill.

As completed by the Appropriations Committee of the House of Representatives, the new naval bill authorizes one new battleship of 16,000 tons displacement, two armored cruisers of 14,000 tons each, three scout ships and two colliers, the total cost of the eight ships to be $28,000,000. The bill also provides for the new naval stations at Guantanamo, Cuba and Olongapo, P. I., and adds 3,000 men to the naval forces.

German Car Axles for India.

According to the *Daily Mail*, the British Government has placed orders in Germany for 800 pairs of axles for Indian railroads. British manufacturers of railroad materials, especially locomotive work, are dissatisfied, as the leading English works had furnished bids, while many works in Sheffield are greatly in need of orders and have been forced to discharge men. It is said that the matter will be discussed in Parliament.—*Consular Report.*

Disastrous Butting Collision at Sand Point, Ontario.

On Tuesday last a butting collision of passenger trains on the Canadian Pacific, three miles west of Sand Point, Ontario, resulted in the complete wrecking of both trains and the death of six trainmen and seven passengers. Many persons were injured. It is said that the westbound train had a telegraphic order to meet the eastbound at Sand Point, but disregarded this order. There was a heavy mist, preventing both enginemen from seeing each other until the moment of the collision.

Fares on Indiana Union Electric Lines.

The Indiana Union Traction Company has put revised rates of fare into effect. These rates are as follows: Single-trip fares, on the basis of 1½ cents a mile (minimum cash fare, 10 cents); round-trip fares on the basis of 10 per cent. reduction from single-trip fares; 250-mile mileage books, good on all lines of the company, $3.25; 1,000-mile mileage books, $12.50. Mileage books will be sold only by company cashiers at passenger waiting rooms. An additional seat fare will be charged on limited trains. This company operates 210 miles of line.

Pensions on the Atlantic Coast Line.

The Atlantic Coast Line has established a Pension Department, with headquarters at Wilmington, N. C. The department began business on Feb. 1, and the board in charge of it consists of G. G. Thomas, J. S. Chambers, R. E. Smith, E. B. Pleasants and H. C. Prince. The basis on which pensions will be paid is the same as that on most of the other roads paying pensions in this country, namely, for each year of the pensioner's service 1 per cent. of his average pay for the last 10 years. The company will appropriate $50,000 a year; if this is not sufficient to meet the demands which may arise under the regulations, a new basis will be adopted, due notice being given. The company will hereafter employ no new men over 45 years old, and none over 35 years unless experienced. Pensions are now paid by 13 American railroads, namely: Atlantic Coast Line; Baltimore & Ohio; Chicago & North Western; Grand Trunk; Delaware, Lackawanna & Western; Illinois Central; Pennsylvania; Pennsylvania Lines West of Pittsburg; Philadelphia & Reading; Union Pacific; Southern Pacific; Oregon Short Line; Oregon Railroad & Navigation Co.

Sites for New Postoffice in New York.

A sub-committee of the House of Representatives at Washington is considering plans for the proposed new postoffice building in New York city. A commission which has served for some time, consisting of the Secretary of the Treasury, the Postmaster General, and the Attorney General, has reported in favor of two sites, one offered by the Pennsylvania Railroad near its new terminal, and the other by the New York Central. The Pennsylvania offers a site which it will sell to the Government for $2,000,000, and proposes a building to cost at least $1,500,000, while the New York Central offers a lease of a structure which it will itself erect at 46th street, near Grand Central station, extending entirely across the terminal yard, above the tracks. Both plans are said to be favored by the Postmaster General, two buildings being necessary to properly handle the great volume of postal business carried to and from New York by these two railroads. The plans offered by the New York Central provide for from 100,000 to 120,000 sq. ft. for postoffice use, the building to be completed within four years, or less, and offered for lease for 50 years, at $90,000 a year. The Postmaster General is understood to be preparing a bill to be introduced in Congress providing for the long lease, since ten years is now the limit of all Government leases.

Hutchinson Salt Rates.

The Interstate Commerce Commission, in an opinion by Commissioner Prouty, has rendered its formal decision in the matter of rates on salt from Hutchinson, Kansas. The gist of it was given in the newspapers several weeks ago. The Hutchinson & Arkansas River Railroad Co. owns between four and five thousand feet of track adjoining one of several plants belonging to the Hutchinson (Kansas) Salt Company, in Hutchinson, known as "trust mills." This railroad company does not own any cars or engines nor is it in any way engaged as a common carrier. Three railroad companies entering Hutchinson made joint tariffs with the H. & A. R., which, on salt shipped to Missouri River points, gave the latter 25 per cent. of the rate, but not exceeding 50 cents per ton. The H. & A. R. is controlled by officers of the salt company and the earnings of the railroad company are subject to that control. Since this division was allowed the salt company has sold salt at Missouri River points at prices with which the independent salt mills in Hutchinson could not compete. The declared purpose of making this joint rate was to enable the salt manufacturers to meet competition from other quarters, and the division of the joint rate could not have that effect unless it inured to the benefit of the salt producer. The Commission decides that granting the division of the rate to this so-called railroad company is a mere subterfuge to give a concession in rate, and is therefore unlawful.

Twenty Years Progress, England and America.

The *Wall Street Journal* presents the following items of comparison of the respective progress of England and the United States during the last twenty years. The table shows percentages of increase.

	Great Britain.	United States.
Population	18	49
National debt	2	*36
Exports	24	87
Banking capital	24	53
Deposits	122	198
Bank clearings, London & N. Y.	69	63
Railroad mileage	20	67
Railroad capital	58	70
Railroad receipts	54	109
Railroad net earnings	24	67
Railroad passengers	285	109
London (New York) traffic	215	145
Shipbuilding	63	1002
Merchant marine	42	43
Sailing ships	*44	*31
Steamers	56	580
Coal production	38	282
Pig iron production	11	291
Cotton consumption	14	169
Wool consumption	30	13
Telegrams	173	117

*Decrease.

In the comparison of bank clearings, the statistics of the clearing houses in London and New York are taken, and not the clearings of the entire country, and the fact that the percentage of increase in clearings is somewhat higher in London than in New York is of interest in view of the fact that in 1903 the aggregate clearings in New York exceeded those in London by 15 billions. The percentages of bank capital and deposits are based in the case of Great Britain on the business of the joint stock banks, and in the case of the United States upon the business of the National banks.

Proposed Railroad Department at McGill University.

The Board of Governors at McGill University, Montreal, has under consideration the proposal to found a school of railroad engineering and transportation in connection with the university. The Canadian Pacific, Grand Trunk and Canadian Northern roads have already agreed to make annual appropriations for the support of the undertaking, and the other railroad corporations of the Dominion are believed to be willing to help. It is believed, not only by the university authorities but by the railroads also, that if such a school can be successfully established the railroad companies will enjoy the advantage of drawing a regular supply of well trained men to their service, while the country at large will benefit from the increased number of scientific men. The faculty of applied science at McGill University already provides for the training of civil, mechanical, electrical and mining engineers, and it is thought that a special department of railroad engineering can readily be added. It is proposed to govern the new school by a special committee, on which the railroad companies will have representation in order that they may watch over the development of the scheme and see that the curriculum is adapted to practical needs.

The preliminary task of drawing up a scheme of studies has been entrusted to a committee which includes Mr. Morse, Third Vice-President of the Grand Trunk, and Mr. McHenry, Chief Engineer of the Canadian Pacific. The work to be done in the proposed department will include location, including all branches of surveying; construction, including the laying out of work, the construction of bridges, buildings, etc.; track elevation and ballasting; organization, specifications and other details. Also operation, including maintenance of way and structures, conducting transportation, equipment, organization and legislation. It is expected that work in the new department will begin next September.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page 16.)

Western Railway Club.

The February meeting will be held at the Auditorium Hotel, Chicago, Tuesday, the 16th inst. There will be three papers, as follows: "Lubrication of Locomotive Valves and Cylinders," by D. R. MacBain, Master Mechanic of the Michigan Central, at Jackson, Mich.; "Square Roundhouses," by George P. Nichols, and "The Effect of Brain Power on Dividends," by A. Bement.

PERSONAL.

—Mr. W. A. Stevenson, General Manager of the Pearl & Leaf River Railroad, has resigned, and will open an office at El Paso, Texas, as Consulting Engineer.

—Mr. Edward M. Underhill, at one time General Auditor of the Southern Pacific (Atlantic System), died at his home in Austin, Texas, on February 5. Mr. Underhill was born in Berwickshire, Scotland, in 1841, and began his railroad service as a clerk in the Secretary's office of the Edinburgh, Perth & Dundee. In 1871 he was elected Secretary and Treasurer of the Mobile & Alabama Grand Trunk, and a few years later became Auditor of Morgan's

Louisiana & Texas. In July, 1886, he was made Assistant General Auditor, and in 1887 was promoted to be General Auditor of the Atlantic System of the Southern Pacific Company.

—Mr. J. J. Dowling, who succeeds Mr. Clark as Master Mechanic of the Great Northern, at Everett, Wash., was born at Baraboo, Wis., in 1864. He began work with the Rhode Island Locomotive Works as machinist apprentice in 1879. The next year he was in the Chicago & North Western shops at Baraboo. In 1885 he resigned from this road to go to the St. Paul, Minneapolis & Manitoba, and two years later became Engineer for the Union Pacific, where he remained until 1893, when he was promoted to the position of roundhouse foreman at Hanover, Kan. In July, 1900, he took a similar position on the Great Northern and two years later became road foreman of engines of the Montana Division, from which position he went to Everett as Master Mechanic.

—Mr. B. R. Pollock, whose promotion to the Superintendency of the Air Line-Northampton Division of the New York, New Haven & Hartford, was recently announced, is a native of Pennsylvania, having been born in Lansford, Carbon county, in 1865. Mr. Pollock, at the age of 14, began railroad work as a telegraph operator for the Lehigh Coal & Navigation Company. In 1882 he went to the New York & New England in a similar capacity, where, in 1885, he was appointed despatcher, in 1892 trainmaster and in 1895 Assistant Superintendent. After the absorption of the New England road by the New York, New Haven & Hartford in 1898, Mr. Pollock continued as Assistant Superintendent of the Highland Division, from which position he was in January last promoted to succeed Mr. Elwell as Superintendent.

—Mr. Charles M. Levey, the new Assistant to President Elliott, of the Northern Pacific, has been General Manager of the Hannibal & St. Joseph. Mr. Levey is a native of Ohio, having been born at Olena in 1858. After receiving a common school education he entered the employ of the Michigan Central as a telegraph operator. In 1872 he resigned to go to the Burlington and was from then until 1883 in various positions. In January, 1883, he was made Assistant General Superintendent of the St. Louis, Keokuk & Northwestern, and the Chicago, Burlington & Kansas City, and in 1887 was promoted to be General Superintendent. In 1892 he was again promoted, being made Superintendent of the Iowa Lines of the Chicago, Burlington & Quincy. Mr. Levey's headquarters will be at Tacoma.

—Mr. William Whyte, who has been chosen Second Vice-President of the Canadian Pacific, has heretofore been Assistant to the President of that road. Mr. Whyte was born in Charleston, Scotland, in 1843. His first railroad service was as station agent for the West of Fife Railway, in Scotland. Then for about 20 years (1863-1883) Mr. Whyte was on the Grand Trunk. He began as a brakeman and was steadily promoted from brakeman to the positions of freight clerk, foreman freight department, yardmaster, conductor, stationmaster, freight and passenger agent, agent and division superintendent. Then for one year (1883-1884) he was General Superintendent of the Credit Valley and in May, 1884, his jurisdiction was extended over the Ontario Division of the Canadian Pacific, which included all lines in Ontario west of Smith's Falls Junction. Then for a year he was General Superintendent of the Eastern Division also, and in October, 1886, he became General Superintendent of the Western Division, from which position in 1897, he was promoted to be Manager of the lines west of Lake Superior.

—Mr. David L. Davis, who died at Readville, Mass., on February 1, at the age of 92, was a veteran railroad man whose career extended back to almost the beginning of the railroad era in this country. He began work for the Boston & Providence about one year after the opening of the road, and he was roadmaster of one division of that company's lines for about 50 years.

—Mr. W. J. Jenks, Superintendent of the Fourth Division of the Seaboard Air Line at Jacksonville, Fla., was born in Wake county, N. C. His railroad service dates from 1885, when he began as a telegraph operator on the Raleigh & Augusta Air Line, now a part of the S. A. L. Later he worked at various points as agent and operator for the Richmond & Danville and the Norfolk & Western, until 1889, when he became train despatcher of the Flat Top Division of the N. & W. road at Bluefield. From then until 1901 he was train despatcher, chief train despatcher and car distributor in the Pocahontas coal fields of the Norfolk & Western. He then went back to the Seaboard Air Line as chief despatcher at Savannah, Ga., and in December, 1901, was made trainmaster, from which position he is now promoted to the Superintendency at Jacksonville.

—Mr. W. F. Buck, the new Master Mechanic of the Arizona Division of the Atchison, Topeka & Santa Fe Coast Lines at Needles, Cal., goes to this company from the Northern Pacific, where he has served for a number of years. He began his railroad service as a machinist for the latter company. In 1893 he was made shop foreman and two years later became General Foreman of shops at Missoula, Mont. Four years afterward (1899) he went to Helena, Mont., as General Foreman of shops, and in 1902 was promoted to be Master Mechanic of the Rocky Mountain Division, from which position he resigned to go to the Santa Fe as Master Mechanic. Upon his retirement from the Northern Pacific his associates presented him with a diamond ring.

—Mr. Henry W. Oliver, the well-known steel manufacturer and capitalist of Pittsburg, died at his home in that city on February 8, at the age of 64. Mr. Oliver was born in Ireland and came to this country in infancy. He went into the iron business at an early age and soon became one of the principal men in that field. He was the head of the Oliver Steel Company, President of the Standard Nut Company of Pittsburg, principal stockholder of the Pittsburg Hinge Works, Beaver Balls, large stockholder in the Pittsburg & Lake Erie Railroad, and a director of the Isabella Furnace. He was a prominent Republican and had been a delegate to many Republican National Conventions.

—Mr. Harry E. Byram, who succeeds Mr. Gruber as General Superintendent of the Southwestern District of the Chicago, Rock Island & Pacific, was born at Galesburg, Ill., 39 years ago. After receiving a public school education, Mr. Byram, in 1881, began his railroad work as a call boy for the Chicago, Burlington & Quincy, and remained with that road until 1889. Then for about five years he was out of railroad service, but returned in August, 1894, as a clerk in the office of the President of the Great Northern. Then for about a year he was Assistant General Superintendent of the Montana Central at Great Falls, and in October, 1899, was made Superintendent of the Cascade Division of the Great Northern at Everett, Wash. From October, 1902, until the first of this month he was assistant to the First and Fourth Vice-Presidents of the Chicago, Rock Island & Pacific, and on February 1 last became General Superintendent of the Southwestern District.

—With the death last week, Thursday, in Bridgeport, Conn., of William Darius Bishop, formerly President of the New York, New Haven & Hartford, there passes an officer who was one of the few connecting links between the old system of railroad management and the new. He was at once a symbol and, to some extent, a surviving force of the old conservatism as distinguished from the up-to-date railroad methods expressed by such terms as consolidation, expansion, large financing and traffic operation on a great scale. And, as it happened, he was for some years head of a corporation which was ultra-conservative even in a conservative railroad period and which had to wait through yet another administration before it outgrew its traditions. Mr. Bishop came of railroad stock, the son of Alfred Bishop, whose name as contractor and builder was linked with the construction of the Morris Canal, a number of western railroads and the Rensselaer & Saratoga, Housatonic, Naugatuck and New York and New Haven lines in the East. The younger Bishop was born in Bloomfield, N. J., Sept. 14, 1827; was graduated at Yale in the class of 1849, and, although by taste and abilities marked out for public life, rather than for a railroad career, was by circumstances forced immediately into the railroad vocation through the necessity of taking up an uncompleted railroad contract of his father for building the Naugatuck Railroad. He became the first Superintendent of that line, and afterwards President; was closely identified with its later management, was a very large holder of its stock, and lived to see a most remarkable development of the Naugatuck Valley and his shares rose from nominal value to nearly 300 following the ten per cent. lease of the line to the New York, New Haven & Hartford. During this period he also joined railroading with public activities and ambitions; was elected (1857) as a Democrat to the Thirty-fifth Congress, acquired fame as an eloquent and able speaker in political campaigns, and was recognized as a promising party leader in his state. Under President Buchanan he served successfully for a year as United States Commissioner of Patents. But although many years later he was twice elected to the Connecticut legislature, his civic activities were subordinated to his railroad interests and duties. In 1867 Mr. Bishop was chosen President and became the working head of the New York & New Haven Company, holding that position for twelve years. The leading event of his administration—and an important one for those days—was the consolidation of his line with the Hartford & New Haven Company, forming thus the main stem of a through route between New York and Boston, and one on which the great New Haven system was subsequently to be built up. The merger gave Mr. Bishop and his directorate control of a double track line of 123 miles between New York and Springfield, Mass., through a region of large population and constantly developing railroad business, and during his administration the acquired control of the Shore Line between New Haven and New London and of the Harlem & Portchester branch not only meant new business but in remoter aspects important steps in developing the through route to Boston. But Mr. Bishop, as stated, was a conservative in conservative times and was supported by an old-fashioned board of directors. The receipts of the company from passengers were double those from freight and there was a strong prejudice in favor of a form of traffic which "handled itself;" business was naturally increasing; no rivalries were in sight; the ten per cent. dividends seemed secure, and the accepted policy was to let well enough alone. Why during his presidency Mr. Bishop should have been content with moderate local development of the property can, under such conditions, be readily understood and his views were shared for some years by his successor, President Watrous. As a Director and member of the Executive Committee of the company, ex-President Bishop's conservatism was to some extent out of sympathy with the swift and expansive policy of President C. P. Clark. Mr. Bishop, for example, was pretty strenuously opposed to President Clark's dramatic Wall Street coup by which the New England Railroad Company was bought up as against the Vanderbilt and New York Central interests seeking to secure it, and it can be stated now, on the authority of the spoken words of President Clark himself, that Mr. Bishop's disapproval was a large factor in defeating the President's plan of buying control of the Poughkeepsie Bridge system. By temperament and by training as regards railroad policy, the two men were divergent and it was, perhaps, as well for the corporation that Mr. Bishop's policy was not called upon to meet new-fashioned conditions of territorial control and sharp competition. But as almost the last of the old-time railroad Presidents, he discloses a type which has certain attractions of its own—a type which, if not prescient or progressive, did not speculate in its own properties, overcapitalize or dilute railroad morals by the stratagems of Wall Street, and always spelled integrity and conscientious devotion to the duties of official place. Mr. Bishop was for many years and up to its passing to the "New England Syndicate," a director of the Housatonic Railroad and a director in many corporations not of a railroad character.

ELECTIONS AND APPOINTMENTS.

Algoma Central & Hudson Bay.—The officers of this company are: President, B. F. Fackenthal, Jr.; Vice-President, E. A. Seasongood; Treasurer, M. G. Hopf, and Secretary, H. A. Cushing.

Atchison, Topeka & Santa Fe.—On January 1 a new division was established to be known as the Kansas City Division, with H. W. Sharp as Superintendent in charge. This new division includes about 14 miles main line and about 80 miles of sidings, yard tracks and connections.

Au Sable & Northwestern.—A. R. Code has been appointed General Passenger Agent, with headquarters at Au Sable, Mich., succeeding W. H. Leith.

Bath & Hammondsport.—The officers of this company are: President, C. S. Goldsborough; Vice-President, M. P. Blauvelt; Secretary, D. Bosman, and Treasurer, D. W. Bigoney.

Boston & Albany.—Philip Morrison, hitherto trainmaster, has been appointed Assistant Superintendent, with headquarters at Boston, Mass., succeeding J. L. Snelling, resigned.

Canadian Pacific.—F. P. Brady, hitherto Assistant General Superintendent of the Central Division, has been appointed General Superintendent of the Lake Superior Division, with headquarters at North Bay, succeeding G. J. Bury, transferred.

Frank Lee, hitherto Signal Engineer, has been appointed Assistant Engineer of the Western Division, with headquarters at Calgary, Alberta, succeeding G. M. Lang, resigned.

W. E. Fowler has been appointed Master Car Builder, Eastern Lines, with headquarters at Montreal, Que.

Canadian Railway Commission.—The Railway Commission recently established in Canada has established its office at Ottawa, and the Secretary is Mr. A. D. Cartwright, a barrister and son of Sir Richard Cartwright.

Central of Georgia.—C. B. Wilburn has been appointed Superintendent of the Second Division, with headquarters at Macon, Ga., succeeding C. L. Bruner, resigned.

Chicago, Cincinnati & Louisville.—The offices of the President, Vice-President, General Manager, Auditor, General Freight Agent, General Passenger Agent, Purchasing Agent, Assistant Treasurer, Engineer Maintenance of Way and Chief Engineer are now at Cincinnati, Ohio.

Chicago, Rock Island & Pacific.—See Union Pacific.

El Paso-Northeastern.—G. M. Harrison, Acting Auditor and Cashier, has been appointed Auditor and Cashier, headquarters at Alamogordo, N. Mex.

Grand Trunk.—J. W. Higgins has been appointed Assistant Superintendent, with headquarters at London, Ont., succeeding C. S. Cunningham.

Joseph Price, Vice-President at London, Eng., has resigned.

Kansas City Southern.—T. E. Jarrett, hitherto Superintendent of the Southern Division at Texarkana, has been appointed General Superintendent, with headquarters at Kansas City, Mo., succeeding B. F. Dickson, resigned.

Macon & Birmingham.—William Checkley Shaw has been elected Vice-President. O. M. Grady has been appointed Superintendent in charge of transportation, roadway and mechanical departments, succeeding J. R. Lane, General Manager, resigned. The office of General Manager has been abolished. W. F. Buchanon has been appointed Auditor. John M. Cutler has been appointed General Freight Agent, succeeding J. A. Streyer. C. B. Rhodes has been appointed General Passenger Agent, succeeding Mr. Streyer. Ben C. Smith has been appointed Treasurer, succeeding E. A. Martell, Comptroller, resigned. The office of Comptroller has been abolished.

Mexican Central.—O. K. Hamilton has been appointed assistant to the Vice-President, with office at City of Mexico. The headquarters of Ben Johnson, Superintendent of Machinery, have been removed from Mexico City to Aguascalientes.

Michigan Central.—J. B. Morford, hitherto Superintendent of the Canada and Michigan Midland Divisions, has been appointed Assistant to the General Manager.

H. H. Adams, hitherto Assistant Superintendent, has been appointed Superintendent of the Canada and Michigan Midland Divisions, with headquarters at St. Thomas, Ont., succeeding Mr. Molford.

Morenci Southern.—G. Notman, Secretary, has been elected Treasurer also.

Northern Pacific.—A. W. Wheatley has been appointed Assistant Superintendent of Motive Power. This is a new office. J. N. Anderson succeeds Mr. Wheatley as Shop Superintendent at Brainerd, Minn.

Charles M. Levey, hitherto General Manager of the Hannibal & St. Joseph, has been appointed Assistant to the President of the N. P., with headquarters at Tacoma.

Oregon & Southeastern.—J. B. Glover has been appointed General Manager, with headquarters at Cottage Grove, Ore., succeeding John H. Pearsons, who has resigned to give more attention to the duties in the New York office of the company.

Pittsburg, Chartiers & Youghiogheny.—The officers of this company are: President, Joseph Wood; Vice-President, E. B. Taylor; Treasurer, J. G. Robinson, and Assistant Treasurer, H. J. McElhaney.

Southern.—D. W. Lum, hitherto Engineer of Bridges and Buildings, has been appointed Chief Engineer of Maintenance of Way and Structures, with headquarters at Washington, D. C. The office formerly held by Mr. Lum has been abolished.

Suwanee & San Pedro.—R. P. Hopkins has been appointed General Freight Agent, with headquarters at Live Oak, Fla.

Tallassee & Montgomery.—R. E. Lutz, Traffic Manager, having resigned on account of ill health, that office has been abolished. A. R. Smith has been appointed General Freight Agent, with headquarters at Montgomery, Ala.

Terminal Railroad Association of St. Louis.—E. F. Kearney, Superintendent, has resigned.

Toledo Railway & Terminal.—J. G. Glazier, hitherto trainmaster, has been appointed Superintendent.

Union Pacific.—J. M. Gruber, hitherto General Superintendent of the Southwestern District of the Chicago, Rock Island & Pacific, has been appointed General Superintendent of the U. P., with headquarters at Omaha, Neb.

Williams Valley.—C. M. Kaufman has been elected President and General Manager.

LOCOMOTIVE BUILDING.

The New York, Ontario & Western is having three locomotives built at the Cooke works of the American Locomotive Co.

The Wiggins Ferry Company, St. Louis, as reported in our issue of Feb. 5, is having three six-wheel switching locomotives built at the Baldwin Works. These locomotives will weigh 136,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; 323 Tennessee iron tubes, 2 in. in diameter and 10 ft. 5 in. long; fire-box, 108$^{3}/_{16}$ in. long and 42⅛ in. wide; tank capacity, 5,000 gallons of water. Special equipment includes: Westinghouse air-brakes, U. S. metallic piston rod and valve rod packings and Leach standing devices.

The Ulster & Delaware, as reported in our issue of Feb. 5, is having three 10-wheel (4-6-0) locomotives built at the Schenectady Works of the American Locomotive Company. These locomotives will weigh 141,000 lbs., with 107,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 60 in.; working steam pressure, 200 lbs.; 320 charcoal iron tubes, 2 in. in diameter and 14 ft. long; fire-box, 96 in. long and 40¾ in. wide; tank capacity, 4,000 gallons of water. Special equipment includes: Westinghouse-American air-brakes, hammered iron axles, Magnesia boiler lagging, Sterlingworth brake-beams, Trojan couplers, Monitor injectors, Ashton safety valves and Consolidated steam heating equipment.

CAR BUILDING.

The Queen & Crescent is reported in the market for 3,,950 freight cars.

The Millen & Southwestern is reported in the market for new equipment.

The Mobile & Ohio is about to let a contract for a large number of freight cars.

The Atlantic Coast Line will build 200 cars at its own shops at Wilmington, N. C.

The Pabst Brewing Company is reported to have ordered 300 beer refrigerator cars from the Pullman Company.

The Cudahy Packing Co. has ordered 235 refrigerator cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Florida Tank Line is asking prices on new or approved second-hand tank cars. Address G. N. Henson, Chattanooga, Tenn.

The Atlantic Coast Line has ordered 200 flat-bottom gondolas from the American Car & Foundry Company. These cars will be built at the Huntington Works.

The Interborough Rapid Transit Company has ordered 200 all-steel passenger cars from the American Car & Foundry Company. These cars will be built at the Berwick works.

The Apex Equipment Company, 11 Broadway, N. Y., is in the market for six 36-in. gage one and one-half or two-yard dump cars in good second-hand condition; give specifications and location for inspection.

The Delaware, Lackawanna & Western has ordered 500 hopper cars of 80,000 lbs. capacity from the Standard Steel Car Company, and 1,000 wooden box cars of 60,000 lbs. capacity from the Pullman Company. For specifications, see our issue of Feb. 5.

The Cleveland, Akron & Columbus, as reported in our issue of Jan. 29, has ordered 97 twin hopper gondola cars from the Standard Steel Car Company. These cars will be 40 ft. long, 9 ft. 5⅝ in. wide and 4 ft. 2 in. high, inside measurement, with metal underframes.

The Milwaukee Refrigerator Transit Company has ordered from the Pullman Company 340, 36-ft. refrigerator cars of 60,000 lbs. capacity, for May, 1904, delivery. Special equipment includes: Diamond brake-beams, Streeter brake shoes, Fitzgerald air-brake triple valves, More-Jones brasses, Latrobe couplers, McCord journal boxes, Pittsburg Spring & Steel Co.'s springs, Barber trucks, Griffin wheels and American Steel Foundries' bolsters.

BRIDGE BUILDING.

ABERDEEN, S. DAK.—Bids are wanted Feb. 19 by the Board of County Commissioners for building two steel bridges, each 45 ft. long, over Elm River; also for one 45-ft. steel span over the James River, and one 30 ft. long over Mud Creek in Brown county. E. G. Cummings is county auditor.

ALLENTOWN, PA.—Bids are wanted Feb. 18 by James N. Schunmaker, Superintendent of Public Grounds and Buildings at Harrisburg, for building a bridge over Lehigh River at the east end of Hamilton street.

BEATRICE, NEB.—Bids are wanted, March 1, by J. B. Plasters, County Clerk, for building all the bridges needed in Gage County for one year.

BERRIEN SPRINGS, MICH.—Bids are wanted Feb. 24 by James B. Thompson, Chairman of the Bridge Committee, Niles, Mich., for building the steel bridge, 390 ft. long, over St. Joseph River for joint account of the townships of Berrien and Oronoko.

BOWLING GREEN, OHIO.—Bids are wanted March 1 by B. C. Harding, Auditor, of Wood county, for building a steel bridge 240 ft. long over Grassy Creek at Rossford. E. L. Spafford is county engineer.

BRECKENRIDGE, MINN.—Bids are wanted, Feb. 19, by Wilkin County Commissioners, for a steel bridge over the Otter Tail River, at Foxhouse. R. P. Glover, County Auditor.

BUTTE, NEB.—Bids are wanted March 7 by D. A. Sinclair, County Clerk, for building five bridges over Pouca Creek, and one over Kaya Paha River in Boyd county. Combination steel structures are wanted from 42 ft. to 120 ft. long.

EL RENO, OKLA. T.—Bids are wanted, Feb. 23, by the Board of County Commissioners, for building one steel bridge of six spans, each 108 ft. long, and one steel bridge of nine spans, each 126 ft. long, and some other bridge work, over the Canadian River. Earl Beebe is County Clerk.

FARGO, N. DAK.—The Lower House of Congress on Feb. 4 passed the bill authorizing a bridge across the Red River of the North, at Fargo, N. Dak.

GALVESTON, TEX.—C. L. Crandall, Civil Engineer, is asking bids for some bridge work.

GRAND RAPIDS, MICH.—Bids are wanted, Feb. 19, by the Board of Public Works, for a bridge of one 180-ft. fixed span and one 234-ft. swing span over the Grand River at Wealthy avenue. L. W. Anderson, City Engineer.

HARTINGTON, NEB.—Bids are wanted Feb. 18 by L. J. Hoyle, County Clerk, for some bridge work for Cedar county.

HOLTON, KAN.—Bids are wanted Feb. 12 by T. C. McConnell, County Clerk, for building a bridge over Spring Creek, near Netawaka.

KANSAS CITY, MO.—An ordinance has been introduced in the City Council authorizing the Kansas City Viaduct & Terminal Ry. Co. to build a viaduct from Sixth and Bluff streets, over the west bottoms and the Kaw River to a point on Ferry street, between James street and Minnesota avenue, in Kansas City, Kan. The total length is to be 1½ miles, and the cost $1,750,000 or more. The company's franchise will cover a period of 30 years, and includes the right to collect toll. Provision will be made to carry the street car line. Waddell & Hedrick, reports say, have plans ready for building the viaduct.

LONDON, ONT.—Bids are being received by Moore & Henry for building a steel bridge, 160 ft. span, with 50-ft. approaches, over the Thames River, at Adelaide street.

MINEOLA, N. Y.—The bids opened Feb. 1 by Nassau County Supervisors for building a stone, concrete or steel truss bridge over the pond at Glen Cove were: William H. Seaman, Glen Cove: concrete bridge, 50-ft. span, $17,000; 36-ft. span, $14,600. William H. Bowne, Glen Cove: concrete bridge, 50-ft. span, without macadam walks or roadway, $15,850. Dean, Schweir & Sutton Co., New York, submitted six bids at prices ranging from $35,000 to $21,000. New Jersey Bridge Co.: 50-ft. steel bridge, plank flooring, $17,890; steel or concrete floor, $22,400. W. H. Leavitt, New York: concrete bridge, 36-ft. span, $16,530; steel bridge, 50-ft. span, $19,530. Canton Bridge Co., Canton, Ohio: concrete bottom, $29,200; plank bottom, $24,200; Croton Bridge Co., Croton, N. Y.: iron bridge, $29,000. Berlin Construction Co., Berlin, Conn.: concrete bridge, $24,900; steel bridge, $28,000. The Board will take action on the bids at a meeting to be held Feb. 15.

MINNESOTA.—A bill was introduced on Jan. 30 in the House of Representatives authorizing the counties of Sherburne and Wright to build a bridge across the Mississippi River.

NEW WESTMINSTER, B. C.—There is a bill before the Provincial Legislature, authorizing an expenditure of $250,000 additional on the Westminster Bridge over the Fraser River.

PENNSYLVANIA.—Congress has passed a bill authorizing the Mercantile Bridge Company to build a bridge over Monongahela River at North Charles, Pa.

On Feb. 3 the House of Representatives passed the bill authorizing the Eastern Railroad to build a bridge across the Monongahela River in Pennsylvania.

PORTLAND, ORE.—Bids are wanted Feb. 19 by Thomas C. Devlin, City Auditor, for building a steel bridge on Thurman street.

RED LAKE FALLS, MINN.—Bids are wanted Feb. 23 by J. E. Ford, County Auditor, for building a steel bridge 120 ft. long over Red Lake River in this county.

WILLIAMSBURG, KY.—Bids are being asked by J. A. Denham for building an iron bridge about 200 ft. long over Watts Creek for Whitley county. W. T. Smith is county clerk.

Other Structures.

ALTOONA, PA.—In addition to the work already planned by the Pennsylvania Railroad it is said that still more new shops are contemplated, land for this purpose having already been obtained.

ATLANTA, GA.—The Louisville & Nashville, according to report, will, jointly with the other railroads in Atlanta, build a large freight house, to cost about $750,000, and will also make other extensive improvements.

BIG SANDY, TEXAS.—The St. Louis & Southwestern, it is reported, will build shops at Big Sandy, to take the place of those at Tyler.

BRENHAM, TEXAS.—Bids are wanted, Feb. 15, for building a new union passenger station in Brenham, by the Houston & Texas Central and the Gulf, Colorado & Santa Fe. Bids should be addressed to J. N. Miller, Houston.

CALGARY, ALBERTA.—The Canadian Pacific, it is reported, has let a contract to James Thompkins, of Brockville, Ont., to build large car shops at Calgary. The company has also under consideration the building of a large building for offices.

CANTON, OHIO.—The Wheeling & Lake Erie shops were damaged by fire, Feb. 2; loss about $50,000.

HILLSDALE, MICH.—The Alamo Manufacturing Company will rebuild its foundry, recently destroyed by fire. The capital stock of the company has recently been increased to $500,000 for the purpose of making improvements.

LAS VEGAS, N. MEX.—Plans are being made to enlarge the Santa Fe passenger and freight stations.

MARSHALL, TEXAS.—The shops of the Texas Pacific, at Marshall, were destroyed by fire, Jan. 30; loss of about $25,000.

MUSCATINE, IOWA.—The Chicago, Rock Island & Pacific has plans ready for building a new passenger station, on which work will soon be commenced.

ONEIDA, N. Y.—Schubert Bros. Gear Company will receive bids, March 10, for a brick building 33 ft. high, 44 ft. wide, and 140 ft. long, to cost about $10,000.

NELSON, B. C.—The Canadian Pacific, it is reported, will enlarge its shops and make other improvements.

NEW YORK, N. Y.—The New York Central has submitted a plan to the Postmaster-General to lease a building over its tracks for a branch postoffice. The proposed structure, if built, would extend across the yard north of the Grand Central Station.

SPENCER, N. C.—An officer of the Southern Railway says bids are being received by R. A. Dugan, Assistant General Manager, for building a steel frame machine shop 150 ft. wide and 600 ft. long, work to begin next month.

SYRACUSE, N. Y.—The Eckels-Nye Steel Company has bought land 100 ft. x 300 ft., and is planning to build an addition.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA CENTRAL.—Press reports state that this company has been financed, and that a contract has been let to Dowdel & Company, of Chicago, for building the entire line. The proposed route is from Seward, on Resurrection Bay, Alaska, north via Lake Kenai and Cariboo Pass to Atwood, on the Tanana River, 420 miles. It is stated that work will be begun at once. G. W. Dickinson, Tacoma, Wash., is president and general manager. (Oct. 9, p. 730.)

ALBUQUERQUE EASTERN (SANTA FE CENTRAL).—An officer writes that contracts will be let within 60 days for grading this line from Moriarty, N. Mex., to Albuquerque, 45 miles. Grading was begun last summer, but after 12 miles had been finished the work was stopped. The company has completed surveys for an extension from Torrance, N. Mex., southeast to Roswell, 125 miles. This road is being built in the interest of the Santa Fe Central. The headquarters of the company are at Albuquerque, N. Mex. (July 22, p. 72.)

ARIZONA SOUTHERN.—Articles of incorporation have been filed by this company in Arizona. It is proposed to build from Red Rock, on the Southern Pacific, south to

the mines of the Imperial Copper Company, 21 miles. E. B. Gage, W. F. Staunton and W. N. Kingsley are incorporators.

ARKANSAS, MISSOURI & KANSAS.—A charter has been granted this company in Kansas. The proposed route is from Chanute, Kan., southeast via Joplin, Mo., to Memphis, Tenn. The first 25 miles of the line are under contract to the Atlas Construction Company. W. D. Spooner, Joplin, Mo., is Chief Engineer. (July 10, p. 519.)

ATLANTIC & WESTERN.—An officer writes that work is now in progress on this proposed line from Goldsboro, N. C., to Sanford, 80 miles. Track has been laid between Sanford and Jonesboro, a distance of four miles. W. J. Edwards is President.

BUFFALO & SOUTHEASTERN.—This company has been organized in New York to build an electric railroad from East Aurora northwest to Buffalo, 15 miles. F. H. Ball, T. S. Miller, E. E. Henshaw, B. J. Cole and others, of East Aurora, are incorporators.

COLUMBUS & LAKE MICHIGAN.—This company proposes to build extensions from Lima, Ohio, southeast to Columbus, 90 miles, and from Defiance northwest to a point on Lake Michigan, 200 miles. It is stated that surveys will be begun within 60 days. C. T. Hobart, Lima, Ohio, is Chief Engineer. (August 14, p. 594.)

COLUMBUS, GREENSBURG & RICHMOND (ELECTRIC).—Press reports state that this company has let a contract to Jeup & Moore, of Indianapolis, for the preliminary work on its line. The proposed route is from Columbus, Ind., through Greensburg and Connersville to Richmond, 100 miles. Rights of way have been secured and surveys have been completed. C. N. Wilson, Indianapolis, is General Manager. (Jan. 29, p. 88.)

DELAWARE & HUDSON.—It is officially stated that this company will build a branch from Thurman on its Adirondack division to Warrensburg, 5 miles. Between Albany and Warrensburg there is an electric road 75 miles long; this new extension will give the Delaware & Hudson a line 70 miles long between the two points. (Oct. 2, p. 714.)

EDMONTON, ATHABASCA & MACKENZIE.—An application may be made at the next session of the Dominion Parliament to incorporate a company with power to build a railroad from Edmonton, N. W. T., in a northerly direction through the Territory of Athabasca to the Great Slave Lake, in Mackenzie Territory, a distance of approximately 500 miles. Sutherland & Manning, Winnipeg, Man., are acting for the incorporators.

FINDLAY, FOREST & MARION (ELECTRIC).—This company has been incorporated in Ohio to build an electric railroad from Findlay southeast to Marion, 40 miles. W. B. Beebe, M. B. Earnhart, W. A. Morrison and others are incorporators.

FLINT RIVER & NORTHEASTERN.—It is reported that this road has been finished from Pelham, Ga., to Ticknor, on the Georgia Northern, a distance of 20 miles. T. H. Sale, Pelham, Ga., is President. (May 29, p. 384.)

FORT FRANCES, MANITOU & NORTHERN.—Application will be made at the next session of the Dominion Parliament for an act incorporating this company, with power to build from a point on the national boundary near Fort Frances, Ont., past Manitou Lake northeast to Dinorwic, 90 miles, and thence in a northeasterly direction to a point on the Albany River.

FORT SMITH & WESTERN.—Press reports state that this company will extend its line from Fort Smith, Ark., northeast to St. Louis, Mo., approximately 325 miles. The road was recently completed between Guthrie, Okla. T., and Fort Smith, Ark., 150 miles.

HERRIN & SOUTHERN.—This company has been incorporated in Illinois to build a railroad from a point on the Illinois Central, near Herrin, in a southerly and southwesterly direction for a distance of 5½ miles. The principal office of the company is at Chicago, and the Illinois Central is reported to be behind the project. S. F. Andrews, A. P. Humburg, F. L. Delay and E. O. Hunt are incorporators.

JOPLIN, NEOSHO & PIERCE CITY (ELECTRIC).—Preliminary surveys have been completed for this proposed electric railroad from Joplin, Mo., southeast through Sarcoxie, Pierce City and Granby to Neosho, 35 miles. Victor Grieb, Carthage, Mo., is Chief Engineer. (Dec. 25, p. 930.)

LICKING RIVER.—An officer writes that this line has been completed between Morgan, Ky., and Devil's Creek, three miles. An extension will shortly be built southeast into coal fields in Morgan County, a distance of eight miles, and grading will be begun by March 1. (Dec. 11, p. 896.)

LUDLOW & SOUTHERN.—This road has been completed from Ludlow, Cal, to the mines of the Bagdad Mining and Smelting Company, a distance of eight miles.

MALAD VALLEY.—An officer writes that this road has been completed from Brigham to Garland, Utah, 21 miles. Surveys have been made for an extension from Garland to Malad City, but work will probably not be begun for several months. William Ashton, Salt Lake City, is Resident Engineer. (May 1, p. 320.)

MEXICAN ROADS.—The Compania Carbonifera de Monterey has decided to build a railroad from Villa Musquiz, where the coal mines of the company are situated, to a point on the Mexican International. The principal office of the company is at Monterey, Mex.

The Jimulco Mining Company is about to let a contract for a narrow gage railroad eight miles long, to run from its mine to a point on the Mexican Central. O. S. Newell, San Antonio, Texas, can give information.

The Agricultural and Industrial Company, of the City of Mexico, is about to build a railroad from San Blas, in the State of Jalisco, east to Tepic, 30 miles. The road will traverse a rich agricultural district. J. R. Wahl, City of Mexico, is interested.

Under the concession obtained by the Southern Railroad of Yucatan, it is stipulated that within one year the railroad company must complete at least 30 miles of road, and during each successive period of two years, 60 miles additional must be completed, so that all the lines comprised in the company's original concession shall be entirely completed within 12 years from November, 1903.

A concession has been granted to the San Gregorio Railroad to extend its line to Gonzalez, on the National of Mexico, 11 miles. The road runs at present from Marfil, in the state of Guanajuato, to the mining camp of San Gregorio.

The Cieneguita Mining Company is about to build a railroad from its property to Minas Prietas, 100 miles. The Cieneguita Mining Company owns several large mines near the Yaqui River, in the state of Sonora.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—This company has completed its extension from Birchwood, Wis., northwest to Reserve, 20 miles. (April 3, p. 256.)

MINNESOTA CENTRAL.—A contract has been awarded to C. E. Coon & Co., of Houston, Texas, for building 110 miles of this railroad, from Mankato, Minn., northeast through St. Cloud towards Duluth. The contract price is said to be $1,500,000, and the work must be completed within 18 months. D. H. Beecher, Grand Forks, N. Dak., is President and E. H. Mackenzie, Gaylord, Minn., is Secretary. (Dec. 4, p. 878)

MISSISSIPPI VALLEY.—Surveys are reported in progress on this proposed road from Tyler, Ark., southwest to Blytheville, 25 miles. The road has been financed and contracts for grading will be let as soon as the surveys are completed. W. E. Ayers, Osceola, Ark., is chief engineer, and H. A. Tyler, Hickman, Ky., is president. (Jan. 22, p. 72.)

MISSOURI, KANSAS & OKLAHOMA (M., K. & T.).—This company has completed its line from Oklahoma City northeast to Stevens, Ind. T., a distance of 150 miles. It is stated that the line will be open for traffic on March 1. (July 31, p. 562.)

MORELAND-BON AIR.—A charter has been granted by the Tennessee Legislature to W. H. Pelton, of Cleveland, Ohio, to build a railroad from Moreland, Ky., southwest through Liberty, Dunnville and Russell Springs to Bon Air, Tenn., 110 miles. Connection will be made with the Cincinnati Southern at Moreland, and with the Nashville, Chattanooga & St. Louis at Bon Air.

NEW YORK, NEW HAVEN & HARTFORD.—At a recent meeting of the directors, it was voted to build two additional tracks on the Harlem River branch, which runs from Willis avenue, New York city, to New Rochelle, N. Y., 12 miles. This branch is now double track. The freight traffic is heavy and there are 26 passenger trains each way daily.

NEW YORK, TEXAS & MEXICAN.—It is reported that this company will build an extension from Hawkinsville, Tex., to Velasco, 21 miles. It is also stated that the line from Houston to San Antonio, Tex., will be improved by reducing the present grades and curvatures. E. B. Cushing, Houston, Tex., is the engineer in charge of the work.

NORTHERN MAINE SEAPORT.—Articles of incorporation have been filed by this company, in Maine. It is proposed to build an electric railroad from La Grange, Me., south to Belfast, 60 miles. The line will connect with the Bangor & Aroostook and with the Belfast branch of the Maine Central. The company is capitalized at $350,000. Ed. Stetson, B. B. Thatcher, H. P. Oliver and others are directors.

OREGON & SOUTHEASTERN.—An officer writes that work has been suspended for the winter on this road, which is being built between Cottage Grove, Ore., and Bohemia, 32 miles. Grading has been completed for a distance of 18 miles out of Cottage Grove, and 16 miles of track have been laid. A. B. Wood, Cottage Grove, Oregon, is Chief Engineer.

ORFORD MOUNTAIN.—Work is in progress on an extension of this line from Kingsbury, Que., to Windsor Mills, 10 miles. This company proposes to build two other extensions from Eastman to Potton Springs, 12 miles, and from Eastman to Bonallie Lake, five miles. H. C. Cleveland, Kingsbury, Que., is Chief Engineer. (June 19, p. 450.)

OTTAWA & JAMES BAY.—Application will be made at the next session of the Dominion Parliament for the incorporation of a company to build a railroad from Ottawa northeast through Buckingham to James Bay, with a branch line from Buckingham to the Ottawa River near Thurso, Que. MacCracken, Henderson & McDougal, Ottawa, are acting for the promoters.

PANHANDLE & GULF.—An officer writes that this road, which is being built between Sweetwater, Texas, and Presidio Del Nort, 350 miles, has been graded from Sweetwater to Red River 160 miles and from Sweetwater south to San Angelo 25 miles. The entire road is under contract to the International Construction Company, of Kansas City, Mo. Work is at present at a standstill, but grading will be begun again in the spring. A. E. Stilwell, Kansas City, Mo., is President.

PRINCE EDWARD ISLAND R. R.—Surveys have been finished for an extension of the Murray River branch from Murray River, Prince Edward Island, to Machius Point, and also from Montague Bridge to Cardigan. This is a government line and the date when work will be begun depends on whether a subsidy is secured at the next session of Parliament. H. J. Mackenzie, Moncton, N. B., is Chief Engineer.

RALEIGH & PAMLICO SOUND.—It is stated that additional contracts for grading will be let about Feb. 15. This proposed road is to run from Raleigh east through Wilson and Greenville to Washington, 95 miles, and grading is now in progress on the first 10 miles of the line. The character of the work is light, with one per cent. grades and a maximum curvature of four degrees. J. M. Turner, Raleigh, N. C., is President. (Feb. 5, p. 104.)

ROGERS SOUTHWESTERN.—This company, which was recently chartered in Arkansas to build from Rogers to Siloam Springs, 30 miles, has elected the following officers: R. L. Nance, president; J. C. Applegate, vice-president, and J. E. Felker, treasurer. The headquarters of the company are at Rogers, Ark. (Feb. 5, p. 104.)

SOUTHERN PACIFIC.—This company is asking bids for building a cut-off from Third and Townsend streets, San Francisco, south along the bay to San Bruno, 11 miles. The work will include five tunnels.

STANLEY, MERRILL & PHILIPS.—An officer writes that work is now in progress on an extension of this road from Hannibal, Wis., north to Glenflora, 20 miles. Hill, Winston & Company, Hannibal, Wis., are the contractors. Rights of way have been secured and surveys are completed. There are several portions of the road on which work will be sublet in the near future. (Dec. 18, p. 912.)

STRATHROY & WESTERN COUNTIES.—This company, which has the power to build a line north from Strathroy, Ont., is to apply at the next session of the Ontario Legislature for power to build a line southeast from Strathroy to Port Stanley, Ont., 35 miles.

TEXAS & PACIFIC.—The Port Allen branch of this road has been extended from Torras, La., west to Ferriday, 48 miles.

UNION PACIFIC.—It is reported that this company has completed plans for building a branch line from Rawlins, Wyo., south to Craig, Colo., 120 miles. The new line will pass through the Grand Encampment country and the Pearl copper mining district. It is reported that the company has already ordered 800,000 ties for this proposed extension.

VIRGINIA ROADS.—It is reported that the Virginia Anthracite Coal and Railway Company will build an extension from its Merrimac mines to Blacksburg, four miles. L. A. Randolph, Blacksburg, Va., is president of the company.

WALKERTON & LUCKNOW.—Application will be made at the next session of the Dominion Parliament for an act incorporating a company to build from Walkerton southwest to Lucknow, 20 miles. A. H. MacDonald, Guelph, Ont., is interested.

WASHINGTON ROADS.—The Copper & Gold Mining Company, of Seattle, Wash., has let a contract to W. R. Robb & Company for building 12 miles of railroad from Darrington, Wash., to the company's mines, at the head of Clear Creek. Work will be begun at once and will include one tunnel 500 ft. long. C. G. Austin is vice-president and general manager.

GENERAL RAILROAD NEWS.

CENTRAL OF NEW ENGLAND.—See New York, New Haven & Hartford below.

CHICAGO & EASTERN ILLINOIS.—This company has filed a mortgage for $8,000,000 with the Central Trust Company of New York, as trustee. The proceeds from the sale of the bonds will be used to pay for the line which was recently completed between Findlay, Ill., and Pana.

CHICAGO & NORTH WESTERN.—This company has purchased the logging road of the Wisconsin Land & Lumber Company, which runs from Aniwa, Wis., to Regina, 45 miles. It is stated that the road will be made standard gage and will be extended to Shawana.

DELAWARE & HUDSON.—This company has announced that it will issue $7,000,000 of new stock. The proceeds from the sale of this stock will be used to retire the bonds of the New York & Canada, and to pay for the change of gage on the Chateaugay, between Saranac Lake and Lake Placid. A circular has been issued which says: "The managers have decided, subject to the approval of the stockholders, to issue new stock to the amount of $7,000,000. This new stock will be offered to the present stockholders at 135, one new share for every five shares now owned; and the stockholders will be asked to authorize the issue of $3,000,000 additional stock (making $10,000,000 in all) for similar purposes in the future if the same shall be found necessary.

LITTLE ROCK & HOT SPRINGS WESTERN.—A. G. Edwards & Sons, St. Louis, Mo., are offering at 90 and interest, part of the $1,140,000 first mortgage four per cent. gold bonds of this company, due July, 1939, and guaranteed by the St. Louis, Iron Mountain & Southern. The road extends from Hot Springs to Junction, Ark., 53 miles, and the entire capital stock was recently purchased by the St. Louis, Iron Mountain & Southern.

MISSOURI PACIFIC.—This company has sold $6,000,000 of its five per cent., two-year notes to Baring, Magoun & Co., of New York, and Kidder, Peabody & Co., of Boston. These notes are secured by the preferred stock of the Wabash, the Denver & Rio Grande and the St. Louis, Iron Mountain & Southern.

NEW YORK, NEW HAVEN & HARTFORD.—It appears to be generally understood that this company has used the proceeds of the recent $5,000,000 debenture bond sale to purchase a controlling interest in the Central of New England. The C. N. E. extends from Hartford, Conn., and Springfield, Mass., westward to Campbell Hall, N. Y., the total length of the lines being 200 miles.

PENNSYLVANIA COMPANY.—This company has sold $50,000,000 of its 4½ per cent. notes, to run 18 months from April 1. The proceeds from the sale of the notes will be used for improvements on the lines west of Pittsburg. The notes are endorsed by the Pennsylvania Railroad Company. The Pennsylvania Company will deposit most of the proceeds of the notes in the banks from which the money was borrowed, and will probably get three per cent. interest on the money thus deposited. The bankers' commission on the sale of the notes will make the interest cost to the Pennsylvania Company equivalent to about five per cent.

QUEBEC BRIDGE.—At a meeting of the stockholders of this company, on Jan. 28th, it was voted to approve a bond issue for $6,678,200, guaranteed by the Dominion Government. The Royal Trust Company of Canada is trustee.

SOUTHERN PACIFIC.—Application has been made to the New York Stock Exchange to list $15,000,000 additional general mortgage collateral trust 4½ per cent. bonds of this company. These bonds are a part of the 2-5 year bonds issued in 1900 to pay for the purchase of the Pacific Mail Steamship Company. Kuhn, Loeb & Co. and Speyer & Co. have recently purchased $8,000,000 of this issue from the Southern Pacific.

TEXAS & PACIFIC.—At a meeting of the directors of this company, on Feb. 8, it was decided not to pay the interest on the second consolidated mortgage income bonds. The amount of these bonds outstanding is $25,000,000. An official statement says: The floating debt at present is about $1,600,000, and, although the debt was not materially increased during the fiscal year, the directors decided that the surplus should be devoted to its payment. As seven-eighths of these income bonds are held by the Missouri Pacific, there was no opposition to having the interest passed at this time.

UNION TRACTION (NEW YORK).—The directors of this company, which operates street railroads in Albany and Troy, have approved the issue of a mortgage for $6,500,000. The bonds are to be used in part for the redemption of outstanding bonds of subsidiary companies, and for improvements already made and in progress; and also for future extensions and betterments. Of the total amount only $900,000 will be issued at present. The Central Trust Company, of New York, is trustee.

WESTERN PACIFIC.—This company has filed a first mortgage for $50,000,000, with the Bowling Green Trust Company, of New York, as trustee. The bonds are to run 30 years, with interest at 5 per cent. This company proposes to build a railroad between Salt Lake City, Utah, and San Francisco, Cal., and as a part of the scheme may buy existing railroads. The enterprise is generally believed to be backed by George J. Gould and John D. Rockefeller.